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JPRS 81477

9 August 1982



# USSR Report

## CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 61



FBIS FOREIGN BROADCAST INFORMATION SERVICE



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## CONTENTS

APPLICATIONS



NETWORKS



PERSONALITIES



CONFERENCES AND EXHIBITS

PUBLICATIONS

MOSCOW REPORTS COMPUTER EXPERT INTERVIEW

LD301314 Moscow in English to North America 2300 GMT 29 Apr 82

[Text] With the spread of computers into all facets of life, their manufacture here in the Soviet Union developed in the 1970's into one of the most dynamically growing industries. Today the Soviet Union produces computers of all types, from pocket calculators to extremely sophisticated machines that help to run whole industries. Nevertheless, for the present we in this country cannot say we are fully pleased with the level attained in computers. Why is this so?

To get at the root of the reasons for this, we interviewed Dr Anatoliy Alekseyev, a director of the computing center of the Siberian division of the Soviet Academy of Sciences. You'll hear this interview in English translation:

[Question] Dr Alekseyev, it's the prevailing opinion in the West that the Soviet Union is far behind the United States and other Western countries in computer technology. How justified is this opinion?

[Answer] Well, I believe we are lagging somewhat behind. To understand why this is so, you must recall that the United States and the Soviet Union started out in this field in very different conditions. In the United States the first computers appeared in 1943 and 1944. The Soviet Union was at that time bearing the brunt of the struggle with Hitler Germany. We simply were not able to devote the necessary talent and resources to developing computers at that time. Naturally, this gave the United States a head start. On top of this, in the years that followed there were certain miscalculations in the Soviet Union. The emphasis in this situation is now changing and the gap between our two countries in computers is narrowing.

We now have the same computer component facilities as the United States has and our industry produces a whole range of computers that other developed countries have. We now lag behind the United States mainly in the number of computers in use and, possibly, in what might be called super computers. But then the United States hasn't so many of these either. In the Soviet Union, we now have very many computer systems shared by many users and this to a large extent makes up for the gap in the numbers of computers in use in our two countries. In their overall power the collectively used systems in

the Soviet Union are fully the equals of the American super computers. This enables Soviet scientists to handle problems just as complex as those handled by their American counterparts. This is borne out most strikingly by the success of the Soviet space program, in which every project requires an enormous amount of computing.

[Question] Dr Alekseyev, the American administration's sanctions. [sentence as heard]

[Answer] Well, first of all let me say that such a policy is directly at variance with the spirit of international scientific cooperation. At the same time, it seems to me to be a very ineffective policy. For one thing, all the computers we bought from the United States are serviced by Soviet engineers and whenever an American component fails they simply replace it with a Soviet component. Secondly, I feel that such an embargo can have an effect quite opposite to that anticipated by the American administration. All this naturally invigorates our own work to expand computer component facilities and computer architecture. The result may well be that the present lagging behind of our country that I mentioned will be overcome even faster than might have been expected.

[Question] Are Soviet computer experts in touch with their American colleagues?

[Answer] Our scientists in Novosibirsk had fairly extensive contacts with American scientists, for instance in climatic studies, in simulating atmospheric and oceanic processes and in geophysics. We also worked together on an early warning system to signal the approach of the huge tidal waves in the Pacific, known as tsunamis. All this research was done jointly and it would be hard to say which side was in the lead overall. Both sides benefited equally from such cooperation. Unfortunately, such contacts with the American scientists have now been suspended. I feel this can only have an equally adverse effect on both our countries.

CSO: 1863/206-F

CONDITIONS PREVAILING WHEN A COMPUTER IS INTRODUCED

Moscow DEN'GI I KREDIT in Russian No 8, Aug 81 pp 48-51

[Article by E.I. Komarova, chief accountant at the Donetsk Oblast Gosbank Office, and V.A. Kirichek, chief of the computer center]

[Excerpts] As is known, Donetskaya Oblast is an oblast with a highly developed industry and intensive agriculture. During the 10th Five-Year Plan alone, credit investments in the economy of the oblast increased 17.5 percent. The volume of credit investments in agriculture doubled, and in construction they increased by a factor of seven.

In this connection the number of documents processed by the on-line accounting equipment in Gosbank establishments has grown 34 percent compared with 1974.

During the period December 1974 through October 1979 all 43 of the Gosbank establishments in the oblast were brought into the system of servicing by the computer center. Automated data processing is an effective means for raising labor productivity among on-line accounting personnel. With the introduction of the "Bank" complex, accuracy and reliability in calculations done by the bank were improved, the time used to compile bookkeeping and statistical reports was significantly reduced and some part of working time in the on-line accounting apparatus was made available for internal bank control and economic work.

The transfer of the banking establishments to servicing by the computer center was made difficult as the result of a lack of certain technical facilities. In addition, the computer center was geographically distant from the office because it is located in Makeyevka city while the office is in Donetsk city.

Data transmission via communications channels requires the installation in Gosbank establishments of punchtape telegraph equipment since this makes it possible to transmit totals for assets remaining in individual accounts in cases there there are delays in the receipt of information.

The use of telegraph equipment in the Gosbank establishments requires precise organization of technical maintenance. For this purpose an exchange inventory of telegraph units and a mobile workshop were set up in the computer center, making it possible to solve questions of technical maintenance operationally.

Implementation of the measures outlined facilitated the successful transfer of Gosbank establishments to servicing by the computer center. We can now say that the main intention--to increase labor productivity among workers in the Gosbank establishments--is being successfully accomplished.

The computer center now handles the following tasks: "Gosbank operational day," "Comprehensive receipt handling and control of interbranch transactions," "Pension transfers" and "statistical accounting." The average daily volume of data processed in the main tasks amounts to 65,000 documents, which includes 55,000 for the "operational day" task.

It should be noted, however, that experience in the practical operation of the computer when transmitting data via communications channels using technical mediums has also revealed a number of substantial shortcomings. Thus, the percentage of error in the data processed remains high at more than 1 percent, and this has led to great losses of time to check data in Gosbank establishments and at the computer center and to irrational utilization of the computer complex. In this connection the office and the computer center jointly decided to prepare the Gosbank establishments for a transfer to more up-to-date data transmission equipment that does not use technical mediums, that is, it inputs data directly to the computer, with a centralized method for detecting errors. This transfer has been made and 36 of the Gosbank establishments in the oblast now input data directly to the computer. The advantage of the new method is obvious: computer loads have been normalized, savings are made of scarce data mediums, and time is used more efficiently. Introduction of conditions with the use of the centralized method for detecting errors has promoted a substantial reduction in labor expenditure on document processing by means of eliminating losses of time on checking of data.

One bottleneck in the technology used for automatic data processing at the computer center remains the return delivery of processed output back to the Gosbank establishments. Office vehicles and the mail vehicles of the communications enterprises are being used for this purpose. In our opinion, it would be advisable to introduce as quickly as possible the return delivery of data (printouts of individual accounts) via communications channels.

Processed output now arrives at most Gosbank departments by the start of the working day for the operational accounting equipment; it does not arrive until 1100 hours at 11 of them. Because the volume of output data is extremely substantial, the use of slow-speed equipment is inefficient, and higher-speed equipment is essential.

There are other difficulties in addition to those of a technical nature. Thus for a long time the computer has not been fully supplied with folding paper tape for the alphanumeric printers. Much of the folding paper obtained locally has not been of the standard weight, which has led to constant adjustments on the alphanumeric printers, premature malfunctions of the devices and poor quality printouts.

The situation is no better with magnetic tape. Under conditions of direct input of data to the computer via communications channels, that is, without any intermediate mediums, great demands are made on the quality of the magnetic tapes in order to exclude any possibility of loss of input, and, consequently, undesirable consequences in the operation of the computer center and the Gosbank establishments caused by its reconstruction.

Growth in the volume of documents processed is leading to an increase in the output printouts and correspondingly to an acute shortage of 375-millimeter color tape. With use running at 2,000 meters, the computer center is given only 500 meters. It should also be noted that deliveries of these materials are irregular.



9642
CSO: 1863/170

INTRODUCTION OF COMPUTERIZED ENTERPRISE PLANNING URGED

Moscow PRAVDA in Russian 24 Mar 82 p 2

[Article by professors I. Kamkov and M. Peskov, Moscow Institute of Economics Statistics: "A Computer Does the Planning"]

> [Text] The amount of work connected with finding new scientific-technical concepts is growing about tenfold every decade. The design of articles is growing more complex, and the more complex they become, the more difficult they are to plan. And this means that traditional "manual" development methods must gradually fade into the past.

Creating new objects today, the engineer, designer and process engineer are no longer in a position to analyze all of the possible variants of the solution to a particular problem, which is why they are compelled to terminate their search when they arrive at the first satisfactory variants. Quantitative growth of planning and design organizations and of the number of specialists they employ would not make things any better.

We believe that the sole solution is to make broader use of progressive methods--multifunctional automated planning systems based on high productivity computers with a well developed software package.

The scientific grounds for synthesizing automated planning systems (SAPRs) have already been created, and such systems are now enjoying practical use in the main enterprises of a number of sectors. The immediate task is to achieve their broad introduction. The principal results would be to reduce the laboriousness and time of planning, upgrade the quality of technical documents and accelerate and facilitate selection of optimum solutions.

The benefit from SAPRs is especially noticeable in the planning of complex equipment. A SAPR can solve the problems associated with optimizing the layout and the locations of components within units, and it can hasten the calculations connected with stability, mechanical strength, rigidity and other characteristics of the new item. An approximately tenfold decrease is achieved in the laboriousness of the work, with a concurrent improvement in plan quality.

One important advantage is that assuming that the software is debugged, mistakes are excluded: The computer cannot be "distracted," and absent-mindedness is not

one of its attributes. Moreover we must also consider the data of engineering psychology, according to which the volume of functions performed in a man-machine system must be distributed about equally. However, man does need a more-sparing work routine.

Experience shows that automated planning methods must be introduced into all stages of planning and design--that is, from selection of the structure and appearance of the new article to the publication of the documents. We know that every new project reflects certain scientific-technical achievements that were in existence at its birth. And the longer development proceeds, the more the ideas "age."

Experience shows that SAPRs are introduced more successfully at enterprises where this work is headed by one of the principal executives endowed with maximum powers--the chief engineer. After all, many concurrent and closely correlated scientific-technical and organizational problems must be solved in the course of this effort. Take for example the technical side of the problem. It is not all that simple to create a complex consisting of computer, peripheral equipment, automated workplaces and automatic production machines and ensure their trouble-free operation. In the organizational aspect we encounter the need for creating a SAPR service and restructuring the planning methods and procedures, the organization of the subdivisions and the functional relationships between subdivisions that evolved by tradition. And this is not the complete list. We also need to account for changes in the psychology of the engineer, the designer and the process engineer on assuming a role in work involving automated and dialogue modes. The personnel problems are no less important here as well.

Today every "self-respecting" organization is introducing automation. And this is not a fad, but the will of the times. But certain questions arise in almost every case: For example, where do we get the programmers, the specialists to create the software, the person to write the algorithms and the people knowing something about computer technology? They are very few in number, even though a number of technical institutions of higher education are giving courses on the fundamentals of automated planning. This means, then, that engineers with what we might call a partially relevant background must tackle this new and complex problem.

The problem of introducing individual subsystems or standard SAPRs borrowed from kindred enterprises is made more complicated by the fact that no systems can ever be strictly identical. The differences are extremely significant; moreover they have to do with the main parameters. This means that any borrowed subsystem must be reworked in application to the conditions of the enterprise attempting to assimilate the "alien" system. This is why we find in some cases that each enterprise must develop a SAPR through its own meager resources, and hence we encounter redundancy: Each enterprise must "invent the bicycle" by itself.

In our opinion it would be suitable to give the job of developing standard SAPRs to specialists at large design offices providing services to different technical sectors: electronics, radio-electronics, optics, machine building, construction and transportation. Then SAPRs could be developed for and introduced into client enterprises before the new enterprises go into industrial operation. This would eliminate a basic shortcoming--acquisition of a computer system without the applicable software.

We could even go further: We could create scientific-production associations and regional enterprises that would design, plan, manufacture and supply standard unified articles for many sectors. In this case the present dispersal of forces among numerous low-output subdivisions created in every enterprise would be eliminated.

But we repeat, we need to think about the personnel problem first of all. The sector institutes and the advanced training departments are doing a great deal to train and retrain SAPR specialists. But unfortunately their technical base is insufficient, and they are compelled to limit their effort to theoretical lessons. What the schools really need are operating training SAPRs based on modern computers and peripheral equipment and capable of supporting extensive practical retraining of students. The experience of efforts to create SAPRs and to retrain specialists in automated planning has shown that this important work is progressing most successfully wherever technicians are not divided into programmers and algorithm specialists--wherever all of the work is concentrated within a single subdivision--a laboratory, a sector or group.

The important problems of the economy and further development of scientific-technical progress dictate the need for broadly introducing SAPRs into the national economy as the principal method of effective planning and as a dependable means of raising planning quality.

11004
CSO: 1863/140

AUTOMATION IN ESTONIA

Tallinn SOVETSKAYA ESTONIYA in Russian 11 Feb 82 p 2

[Article by Tiyna Vel'dre, secretary, section of automated control systems and computational technology, technical and economic council of the Tallinn City Committee of the Estonian CP: "From Islets of Automation to Complex Automated Control Systems"]

[Excerpt] The unified Republic Automated Control System (RASU) includes all the automated control systems being developed in the republic, and is itself in its turn part of the state-wide system. The central role in RASU is played by the Automated Control System for Planning Calculations (ASPR) which is being developed at the Scientific Research Institute of the Economics of Planning and the Computer Center of the Estonian SSR Gosplan with the participation of other organizations in the republic: the Ministry of Communications takes part in developing the "Svyaz'" [Communication] subsystem; the Scientific Research Institute of Construction has carried out a complex whole of tasks serving to establish an information base for multiple-variant three-year planning of construction. An automated system of state statistics is being developed by the republic's TsSU [Central Office of Statistics] and by the latter's collective-use computer center. An automated data bank for statistics pertaining to budgets, industry, capital construction, material-technical supply, and agriculture, has been put into industrial operation. These and many other joint projects serve to resolve the speicific problems of the interfacing of various systems--functional, organizational, informational, programming, and technical problems.

TEHNICAL INTEGRATION IS A PREREQUISITE TO THE FULL UTILIZATION OF ASU [AUTOMATED CONTROL SYSTEMS]. Special attention is deserved by the organization of the technical basis of the integrated systems and especially by the establishment of multi-machine complexes and networks of computers, as well as by the development and introduction of computer software, since this precisely assures systems-wide effectiveness.

Data-processing technology itself becomes different: it is adapted to the possibilities for a direct dialogue between the individual at his working post and the computer, along with the other users.

The Collective-Use Computer Center (VTsKP) of the Estonian SSR TsSU counts among its subscribers regional administrative agencies and various ministries and departments of both union and union-republic and republic jurisdiction. It has developed and introduced on the basis of a unified computer series a remote data-processing technology that includes "packaged," "remote-data processing," and "inquiry-answer," modes. A remote-access collective-use data bank has been developed and is in operation. It is based on data from which republic administrative agencies derive information on the production and economic performance of enterprises.

VKTsP operate or still are being set up in several other organizations as well, including the republic's Academy of Sciences. But as yet the utilization of ASU and computer technology has not been uniformly effective. This is also indicated by the differences in the efficiency of utilization of equipment and annual output per employee in different computer centers in Tallinn.

THE CONVERSION TO THE COLLECTIVE USE OF MEANS OF COMPUTER TECHNOLOGY IS A MAJOR ORIENTATION OF THE 11TH FIVE-YEAR PLAN. The state-wide long-range program provides for putting into operation a substantial number of large collective-use centers as the first stage of the state-wide network during the present five-year plan period. The onus of the conversion from individual to collective use of computer facilities will be handled by the complex centralized service system (KTsO).

This system (in itself an outstanding accomplishment of Soviet science) is being introduced throughout the Soviet Union. In our republic it is being handled by the Tallinn center of the "Algoritm" Association which is now in its 6th year of developing and introducing progressive forms of the use and servicing of computer equipment.

Like a mechanic coming to fix your TV set, an expert is summoned from "Algoritm" when your computer malfunctions. The Tallinn center handles subscriber or warranty maintenance of computers. It already cares for three-fourths of all medium- and large-capacity computers operating in this republic, and in the future it will also care for small computers.

UP-TO-DATE PROGRAMMING ASSURES THE UTILIZATION OF PROGRAM ROUTINES. The Tallinn center maintains the republic's library of algorithms and programs, which includes more than 40 ready-for-use program routines that can be acquired on the basis of a contractual basis along with consultative and other assistance. Documents on operating systems and general-purpose program routines for unified-series computers and automated working posts are published and circulated.

Certain of the republic's computer centers and organizations are developing on their own programs for the computerized calculation of wages and other expenditures, thus inefficiently utilizing scarce personnel, resources, and computer time. There already exist finished standard design solutions and program routines for tasks of this kind, that dispense with the need to develop them individually. But each such "homegrown" programmer thinks his

program to be the best, especially in the beginning. The needless outlays become clear at the end when the final illusions about any "special quality" of such programs become dispelled.

EVERY 3 OR 4 YEARS EXPERTS MUST UPGRADE THEIR SKILLS. Computer equipment and software get renewed every 3 or 4 years. Computer experts, too, should upgrade their skills at such intervals.

In our republic this is done at the training centers of "Algoritm." The Tallinn center, for example, trains experts in hardware for remote data processing. Last year 100 workers of the republic's computer centers and organizations had learned this up-to-date method.

Economic effectiveness is a criterion for assessing the performance of measures to introduce ASU. The Estonian SSR Ministry of Local Industry derived savings of 1.15 million rubles over 3 years (1978-1980) from the introduction of ASU, while at the same time spending capital outlays of 0.36 million rubles plus 0.35 million rubles on design cost. The first stage of the sector ASU of the Estonian SSR Ministry of Meat and Dairy Industry assures annual savings of 648,000 rubles.

The current five-year plan period entails a complicated situation as regards manpower resources and hence it is necessary to relieve manpower for utilization within the national economy. The establishment of the KTsO system will serve to get by with a much smaller labor force, on relieving part of the experts for other needs as a result of autonomous servicing.

1386
CSO: 1863/128

## DUAL-PROCESSOR COMPUTER PRODUCED

Yerevan KOMMUNIST in Russian 11 Mar 82 p 3

[Article by S. Filiposyan, secretary, YerNIIMM (Yerevan Scientific Research Institute of Mathematics and Mechanics) Party Committee: "Computers in the Service of the Five-Year Plan]

[Excerpt] The personnel of the Yerevan Scientific Research Institute of Mathematics and Mechanics celebrated its 25th anniversary and the first year of the five-year plan period with new achievements.

Under the direction of the winner of the State Prizes of the Armenian SSR, Doctor of Technical Sciences A. Kuchukyan, experts have completed the development of the first dual-processor computer complex within the framework of the YeS EVM [Unified System of Electronic Computers]. It is based on two series-produced YeS-1045 computers. In addition to its high productivity (approximately 1,700,000 operations per second in the solution of scientific problems and more than 1,000,000 per second in the solution of economic-plan problems), this complex displays a high reliability and operating economy, as well as high performance characteristics. It is designed for mass production to supply all sectors of the national economy that need high-speed computer equipment.

Another new contribution to the development of the Nairi-family computers was the development of the new model of that family, the Nairi-41 computer, carried out in 1981 under the direction of the chief designer, winner of the Lenin Komsomol Prize, honored engineer of the Armenian SSR G. Oganyan.

The computer equipment developed by the YerNIIMM has been awarded the Lenin Prize, state prizes of the USSR and Armenian SSR, and prizes of the Komsomol. A large number of the enterprise's staff have been awarded orders and medals of the USSR, with the institute itself being awarded the Order of Labor Red Banner.

1386
CSO: 1863/128

MICROCOMPUTER FOR MACHINE-TOOL OPERATION

Yerevan KOMMUNIST in Russian 3 Mar 82 p 2

[Article by V. Adamyants, non-staff correspondent of KOMMUNIST: "A Microcomputer Controls a Machine Tool" under the rubric "On Roads of Scientific Progress"]

[Excerpt] The personnel of the Kirovakan Precision Machine Tools Plant has mastered the series production of the model 4732FZ electromachining notching tool designed by ENIMS [Experimental Scientific Research Institute of Metal-Cutting Machine Tools] scientists and engineers.

The new machine tool is equipped with a digital programmed control (ChPU) device developed on the basis of the Elektronika-60 microcomputer. Data input is performed with the aid of punched tape. Moreover, the operator can formulate a new machining program directly on the spot with the aid of a keyboard on the control panel of the ChPU device. The fact that the device is provided with a CRT screen facilitates correction of the program by the operator, which can be performed in the interactive mode. The direct-access memory of the ChPU device contains a program for machining several components.

This microcomputer, designed on the basis of microprocessors, has broadened the range of technological functions of the machine tool on assuring operation in the three-coordinate frame. It implements the principle of adaptive control of the machining modes and it has increased the cutting speeds. The ChPU device is supplied to the plant by the Leningraders.

The new machine tools have produced considerable interest both in this country and abroad. This year, on orders placed by foreign-trade organizations, these electromachining tools will be produced for the SFRY and Poland.

1386
CSO: 1863/128

PS-200 EXECUTES 200 MILLION OPERATIONS PER SECOND

Kiev PRAVDA UKRAINY in Russian 4 Mar 82 p 1

[Excerpt] Ten years ago the laboratories of the Scientific Research Institute of Control Computers at the Severodonetsk "Impul's" Production Association developed the first specimens of the models M-6000, M-7000, and SM-2. At the time these models were a landmark in the development of computer technology in a specific direction. But science and technological progress gather no moss. Even now there already exists a computer that is 200 times faster than the dual-processor SM-2 complex. This new computer, the PS-2000, performs 200 million operations per second. It is planned to convert in the next few years the entire equipment system to a new element base--the utilization of large integrated microcircuits--and to reach the goal of operating speeds of one billion operations per second.

New equipment.... It is indispensable to modern production, which without it cannot become more efficient and of better quality. It is precisely the introduction of technological innovations, modernization, that makes possible the increase in labor productivity and in production with a smaller number of workers. This is of special importance now that the economy is experiencing a shortage of the labor force.

Mechanization and automation are the most reliable path toward intensification of production. We are accomplishing a lot in this direction. In 15 years the number of mechanized and automated production line in this country increased by a factor of 3.5 and now totals 170,000. The number of complex-mechanized sectors, shops and types of production has increased by a factor of 3.7: 90,000 such lines have been built at industrial enterprises. Zaporozhskaya Oblast is the initiator of the movement for "[Shift] manual labor onto the shoulders of the machine." In that oblast, in the last 5 years alone, 634 continuous-flow, mechanized, and automatic lines were put into operation, 7,000 units of existing equipment were modernized, and 223 new equipment units were developed. In Dnepropetrovskaya Oblast in recent years nearly 1,500 types of complex-mechanized production have been organized.

1386
CSO: 1863/128

KAZAN' COMPUTER PLANT CONTINUES OUTSTANDING PRODUCTION RESULTS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Feb 82 p 3

[Article by A. Stepanov, secretary of the party committee of the Kazan' Computer Plant: "It Is Not Easy for the Leaders"]

[Text] The distinguishing features of socialist competition which has developed at the Kazan' Computer Plant are an orientation to the final results and an effort to produce not only more output, but better-quality output with fewer expenditures. The collective's obligations were published in our newspaper on 13 January.

The second year of the five-year plan got off to a good start. The plan for production of commodity output in January was 102.5 percent fulfilled, while the sales plan was 100.8 percent fulfilled. There is no need to say how important this is for rhythmic fulfillment of the obligations assumed for 1982.

The enthusiastic workers of the anniversary labor watch are making the greatest contribution. They are showing how to keep the promise and complete the annual assignment ahead of schedule, by 25 December. Furthermore, we are supposed to achieve the full growth entirely by raising labor productivity. Indeed, it is not easy to be first in our collective. It means to be a leader of the best; last year about 90 percent of the piece-rate workers fulfilled their production assignments ahead of schedule.

The pre-anniversary socialist competition today is headed by shops Nos 11 and 12. The brigade of N. Kapitonov and the collectives of the sections headed by A. Bogabtsev and N. Tikhonravov are raising the banner of the leaders high. The workers of shop No 7 congratulated their comrades in the section of foreman R. Mustafina with great satisfaction. Rozaliya Amirkhalevna was able to organize work so that this collective emerged victorious in both the first and final weeks of January. To do this they needed to set a very high pace and fulfill production assignments by an average of 125 percent.

Another reason the end of January was memorable for us was our meeting with guests from Brest. A delegation from the Electrical Machinery Plant imeni XXV S"yezda KPSS came to conclude a contract on socialist competition. In it we devoted special attention to raising the quality of output and increasing the

proportion of articles produced with the Mark of Quality. Already today about 93 percent of the plant's output has been awarded the honorary triangular mark. For our primary item it has been reaffirmed three times. We promised in our obligations not only to maintain the level achieved, but also to prepare for certification of another computer, the YeS-1045.

11,176
CSO: 1863/122

SARANSK PLANT LAUNCHES YeS-1022 COMPUTER

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Feb 82 p 2

[Article by V. Noskov, Saransk: "Electronic Helper"]

[Text] The YeS-1022 computer which has been put into operation at the Saransk Tsentrolit Plant has been entrusted with performance of 80,000 operations.

It is remarkable that the computer took over the most labor-intensive computing jobs related to planning primary production and operational accounting for fulfillment of the plan of production of output, its quality, and shipment to customers. In difficult situations it will help select the optimal solution and how to carry it out. Moreover, it will do so in just a matter of minutes. With the launching of this electronic helper specialists at the plant have more opportunities to visit the shops and sections and become actively involved in deciding production questions.

11,176
CSO: 1863/122

## YeS-1060 COMPUTER AWARDED STATE MARK OF QUALITY

Moscow PRAVDA in Russian 29 Jan 82 p 2

[Article: "Mark of Quality for a Computer"]

[Text] Minsk, 28 January (PRAVDA correspondent A. Simurov). The largest electronic computer machine in series production in our country, the YeS-1060, has been awarded the State Mark of Quality.

The workers and specialists of the Minsk Computer Equipment Production Association properly share this success with the engineers and scientists of other Belorussian cities and of Moscow. Through the combined efforts of these collectives they were able to quadruple the internal memory volume of the machine. According to their socialist obligations, in the second year of the 11th Five-Year Plan 82 percent of the Minsk computers will have the Mark of Quality.

11,176
CSO: 1863/122

UDC 681.518.3

# AS-16 DIGITAL SPECTRUM ANALYZER FOR MEASURING AND COMPUTING COMPLEXES

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 1, Jan 82 (manuscript received 27 Nov 81) pp 115-123

[Article by Yu.F. Borovik, Institute of Electronics and Computer Technology, Latvian SSR Academy of Sciences]

[Text] Measuring and computing complexes (IVK's) are being used ever more extensively for the purpose of solving many scientific and practical problems involving an experimental determination of the characteristics of studied processes. Constructed on the basis of general-purpose computers, these complexes make it possible to unite the measuring capabilities of the data converters included in them with the computing and functional capabilities of computers, which makes it possible to solve a broad range of problems involving the gathering, processing and transfer of measurement data. Spectrum analysis, which makes it possible to obtain the most complete information on the studied process, is of great interest in studying random and periodic processes. The use in the structure of an IVK of a digital spectrum analyzer makes it possible to expand considerably the complex's capabilities in experimental determination of statistical characteristics represented in the form of electrical signals of random and periodic processes and phenomena in acoustics, radio engineering, hydrodynamics, geophysics, nuclear physics, physiology and many other fields of scientific research.

The AS-16 digital spectrum analyzer is designed for spectrum analysis by the digital Fourier transform (DPF) method of wideband periodic and stationary random signals and is used as part of an IVK based on an "Elektronika 60" microcomputer or small computers of the SM-3 and SM-4 type. As part of the IVK the analyzer performs the functions of digitizing, quantizing and making estimates of the Fourier coefficients of the studied signal. The computer is entrusted with the functions of programming the analyzer and controlling it in the automatic operating mode, of the statistical processing of measurement data, of protocoling and of representing the results of measurements in a form convenient for the operator, as well as of testing the technical condition of the analyzer.

## 1. Transformation Method

The DPF method, employing the procedure of expansion of the signal in a system of orthogonal periodic functions (PPF's) taking on values only of 0.1 and -1, is used in the analyzer. The use of this method makes it possible to reduce substantially

the number of operations of multiplying multidigit numbers as compared with the fast Fourier transform (BPF) algorithm, and generally to do without multiplication operations in determining Fourier coefficients in a certain frequency band [6].

A procedure for expanding the signal in a system of orthogonal periodic functions meeting the following assignment conditions is employed for determining the Fourier coefficients of the studied signal in the transformation interval of [0, T] with a transformation step in terms of frequency of $\Delta f = 1/T$ :

$$\begin{cases} R_s(i\Delta f,\, t)=R_s(i\Delta f,\, t+kT_i), \quad T_i=\frac{1}{i\Delta f},\ k=0,\,1,\,2,\,\ldots; \\ R_s(i\Delta f,\, t)\in\{0,\,1,\,-1\}; \\ \int\limits_0^{T_i} R_s(i\Delta f,\, t)\,dt=0; \\ R_s(i\Delta f,\, t)=-R_s(i\Delta f,\, -t); \\ R_c(i\Delta f,\, t)=R_s(i\Delta f,\, t+\frac{T_i}{4}); \\ R_c(i\Delta f,\, t)=R_c(i\Delta f,\, -t), \quad i=1,2,\ldots,\, n. \end{cases} \tag{1}$$

In fig 1, as an example, is given the transformation in interval [0, T] of two possible PPF systems meeting the conditions in (1). The expansion of these PPF's into a Fourier series can be represented as follows:

$$R_c(i\Delta f,\, t)=\sum_{k=1}^{\infty} a_{c(2k-1)}\cos 2\pi\,(2k-1)\,i\Delta f t,$$

$$R_s(i\Delta f,\, t)=\sum_{k=1}^{\infty} b_{s(2k-1)}\sin 2\pi\,(2k-1)\,i\Delta f t, \tag{2}$$

where $a_{c(2k-1)}$ and $b_{s(2k-1)}$ are the Fourier coefficients of functions $R_c(i\Delta f,\, t)$ and $R_s(i\Delta f,\, t)$, respectively, at a frequency of $(2k - 1)i\Delta f$ .

Continuous studied signal $x(t)$ , after its digitization and quantization, can be represented in the form of a set of estimates of values of the signal at digitization moments $\{\hat{x}(t_k)\}$ , where $k = \overline{1, N}$ and $N$ is the sample size. Estimates of intermediate coefficients $a_i'$ and $b_i'$ , consistent with the procedure for the expansion of signal $\{\hat{x}(t_k)\}$ in a PPF system are determined as follows:

$$a'_i = \frac{2}{N}\sum_{k=1}^{N}\hat{x}(t_k)R_c(i\Delta f,\, t_k).$$

$$b'_i = \frac{2}{N}\sum_{k=1}^{N}\hat{x}(t_k)R_s(i\Delta f,\, t_k).$$

(3)

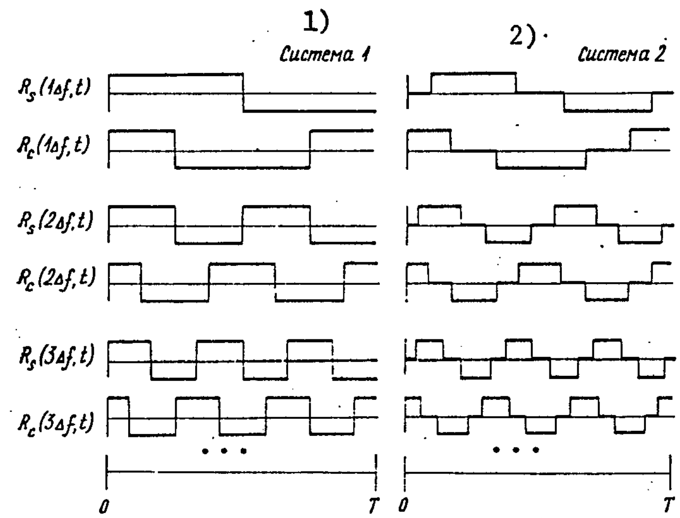



Figure 1. Examples of Possible Systems of Orthogonal Periodic Functions: system 1--$R_{c,s}(i\Delta f,\ t) \varepsilon \{1, -1\}$, s = 3; system 2--$R_{c,s}(i\Delta f,\ t) \varepsilon \{0.1, -1\}$; s = 5; T is the transformation interval

Key:

1. System 1
2. System 2

Substituting expressions (2) in (3), for n frequency transformation points it is possible to write two complete and independent systems of linear equations:

$$a'_i = \sum_{k=1}^{\infty} a_{c(2k-1)}a_p,\quad i = \overline{1, n},$$

$$b'_i = \sum_{k=1}^{\infty} b_{s(2k-1)}b_p,\quad i = \overline{1, n},$$

(4)

where $a_p$ and $b_p$ are values of estimates of Fourier coefficients of signal $\{\hat{x}(t_k)\}$ at point $p = (2k - 1)i\Delta f$ .

If the spectrum of the studied signal is limited by a frequency of $n\Delta f$ and the digitization conditions are so chosen that the condition of the absence of the effect of the superposition of the high-frequency components of the orthogonal periodic functions on the region of analysis is fulfilled, then in equations (4) there is no need to take into account those components of the expansion of PPF's which lie beyond the transformation range $[0, n\Delta f]$ and it is possible to change to finite summation limits in equations (4). The solution of systems of linear equations (4) in terms of estimates of Fourier coefficients $a_i$ and $b_i$ in this case can be represented in the form:

$$a_i = \begin{cases} \dfrac{a'_i}{a_{c1}}, & \text{with } i=\overline{n, n_1+1}, \\[2ex] \dfrac{a'_i - \sum\limits_{h=2}^{l_i} a_{c(2k-1)} a_p}{a_{c1}} & \text{with } i=\overline{n_1, 1}; \end{cases}$$

$$b_i = \begin{cases} \dfrac{b'_i}{b_{s1}}, & \text{with } i=\overline{n, n_1+1}, \\[2ex] \dfrac{b'_i - \sum\limits_{h=2}^{l_i} b_{s(2k-1)} b_p}{b_{s1}} & \text{with } i=\overline{n_1, 1}, \end{cases} \qquad (5)$$

where $\ell_i = [n/2i - 1/2]$ , $n_1 = [n/s]$ , where $s$ is the number of the second non-zero coefficient of the expansion of PPF's into a Fourier Series in (2), and $[\cdot]$ represents the whole part of the expression in brackets.

For the purpose of determining estimates of intermediate coefficients $a'_i$ and $b'_i$ , where $i = \overline{1, N}$ , on the basis of a sample of $N$ readings of the studied signal it is necessary to perform $2nN$ addition and subtraction operations. In the analyzer these operations are performed in real time, which makes it possible to obtain estimates of intermediate coefficients simultaneously with the last reading of the studied signal. From expressions (5) it is obvious that the majority of estimates of Fourier coefficients of the studied signal are determined by simple scaling of estimates of the corresponding intermediate coefficients. This makes it possible to make a spectrum analysis in the $[(n_1 + 1)\Delta f, n\Delta f]$ range, without thereby employing operations of the multiplication of multidigit numbers. The breadth of this range is determined by parameter $s$ of the PPF system selected. For the purpose of determining estimates of Fourier coefficients of the studied signal in the $[0, n_1\Delta f]$ range it is necessary to perform a certain number of operations of multiplication of estimates of intermediate coefficients by coefficients of the expansion of

orthogonal periodic functions into a Fourier series. The number of multiplication operations depends on the spectral composition of the orthogonal periodic functions. The expansion into a Fourier series of the PPF's of system 1 contains all odd harmonics [1]; therefore, for determining estimates of Fourier coefficients of the studied signal from estimates of intermediate coefficients consistent with the procedure for expansion of the signal in system 1, it is necessary to perform the maximum number of multiplication operations for this method. The expansion into a Fourier series of PPF's of system 2 does not contain third, ninth, etc., harmonics [1]; therefore, in carrying out a digital Fourier transform while using this system of PPF's it is necessary to perform a minimum number of multiplication operations. Functions for reduction of the number of real-number multiplication operations for a digital Fourier transform (DPF) algorithm when using these PPF systems, as compared with the fast Fourier transform algorithm, are illustrated in fig 2.

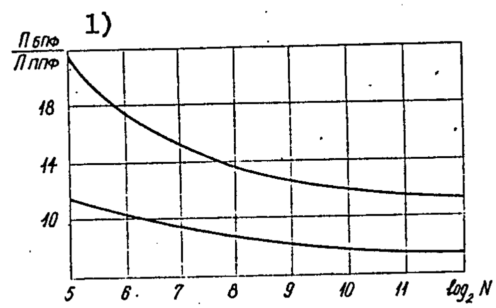



Figure 2. Functions for Reduction of the Number of Whole-Number Multiplication Operations for the Digital Fourier Transform Algorithm While Using Various Orthogonal Periodic Functions, as Compared with the Fast Fourier Transform Algorithm: a--algorithms when using system 1; b--algorithms when using system 2

Key:

1. $P_{BPF}$ [fast Fourier transform]/$P_{PPF}$ [orthogonal periodic functions]

Reduction of the number of multidigit-number multiplication operations, requiring the greatest input of time and hardware, makes it possible to improve the speed of the digital analyzer, to expand the frequency band of the signal studied which is accessible for analysis in real time, and to simplify hardware implementation of the analyzer.

2. Digitization and Quantization Modes

A key aspect of developing a spectrum analyzer employing the method described for the execution of a digital Fourier transform is selection of the digitization mode and flow parameters.

Since orthogonal periodic functions themselves have an infinite spectrum (2), the employment of determinate digitization with a finite value of the digitization frequency, $f_d$, inevitably results in manifestation of the effect of multiple superposition of the high-frequency components of PPF's from regions $kf_d \pm f_d/2$, where $k = 1, 2, \ldots$, onto the region of analysis, similarly to how this occurs with high-frequency components of the studied signal when the requirements of Kotel'nikov's theorem are not fulfilled [2]. If the coefficients of the expansion of PPF's into a Fourier series form a diminishing series, as occurs, in particular, for the PPF systems discussed, then, by selecting the frequency of determinate digitization so that condition

$$f_d \gg n\Delta f \tag{6}$$

is fulfilled, it is always possible to reduce the influence of the superposition effect to the value required in terms of a specific transformation error. However, in analyzing wideband signals this condition is practically unfulfillable because of the limited speed of the quantizing unit and digital data processing units.

In the AS-16 spectrum analyzer is employed the mode of stochastic digitization of the studied signal and PPF system by means of a stream of gate pulses with variance accumulation, which, as illustrated in [3], makes it possible to obtain asymptotically unbiased estimates of the integral characteristics of stationary signal $\{x(t_k)\}$ with any mean digitization frequency regardless of the spectrum of the studied signal. For the purpose of forming digitization moments $\{t_k\}$, where $k = \overline{1, N}$, the principle of the transformation of pseudorandom numbers, $\{\zeta_k\}$, $k = \overline{1, N}$, interdependent and identically distributed over range $[0, D_d]$, into time intervals proportional to the clock rate, $f_t$, is employed. The digitization moments are defined as follows:

$$t_k = t_{k-1} + \Delta t_0 + \Delta t_k, \tag{7}$$

where $\Delta t_0$ is a certain guaranteed time interval required for processing measurement data obtained in the preceding digitization cycle, $t_{k-1}$; and $\Delta t_k = (1/f_t)\zeta_k$ are interdependent and identically distributed time intervals with a mean value of $D_d/2f_t$. The mean value of interval $\Delta t_0 + \Delta t_k$ here determines the size of the mean digitization step.

The stochastic quantizing mode, making it possible to obtain unbiased and valid estimates of coefficients $a_i$ and $b_i$, is used for determining estimates of studied signal $\hat{x}(t_k)$. The number of quantization levels is two each in the positive and negative regions of the transformation range, $[-\chi, \chi]$. A stream of pseudorandom numbers, $\{\xi_k\}$, $k = \overline{1, N}$, interdependent and uniformly distributed over range $[0, D_k]$, is used as a secondary random process. In the case of stochastic quantization of the second kind [4], the values of estimates of the studied signal are determined according to the equation:

$$\hat{x}(t_k) = \left(\xi_{k,\text{н}} - \frac{1}{2}\right) q + n_k q, \tag{8}$$

where $\xi_{k,n} = \xi_k/D_k \in [0, 1]$ is the normalized value of $\xi_k$ and $q = \chi/2$ is the quantization step, and $n_k$ is the number of quantization levels found in range $[0, \chi(t_k)]$.

Taking (8) into account, expression (3) can be represented in the form:

$$a'_i = \frac{\chi}{N}\sum_{k=1}^{N}\left(\xi_{k,n} - \frac{1}{2}\right)R_c(i\Delta f, t_k) + \frac{\chi}{N}\sum_{k=1}^{N} n_k R_c(i\Delta f, t_k),$$

$$b'_i = \frac{\chi}{N}\sum_{k=1}^{N}\left(\xi_{k,n} - \frac{1}{2}\right)R_s(i\Delta f, t_k) + \frac{\chi}{N}\sum_{k=1}^{N} n_k R_s(i\Delta f, t_k). \quad (9)$$

The first terms of expressions (9) do not depend on the studied signal and, since the values and order of succession of pseudorandom numbers $\{\xi_k\}$ are known, then the values of these terms are computed in advance and are used in determining estimates of intermediate coefficients in the form of corrections. The mode of stochastic quantization of the second kind possesses the property, very valuable for spectrum analysis by the DPF method, of independence of the spectral density of the quantization noise power on the studied signal [5]. This makes it possible in determining the spectral density of the power of the studied signal to take into account the spectral density of the quantization noise power in the form of a correction.

Since an estimate of the spectral density of the power of a harmonic signal with a frequency of $i\Delta f$ is inversely proportional to the size of the frequency transformation step, $\Delta f$, then the ratio of estimates of the spectral density of the power of the harmonic signal and quantization noise increases with a reduction in $\Delta f$. This makes it possible in determining estimates of the spectral density of the power of periodic signals when employing large sample sizes, $N$, to employ stochastic quantization of the first kind [5], whereby estimates of intermediate coefficients are determined without taking into account the first terms in expressions (9). Thus, in both cases the algorithm for determining estimates of intermediate coefficients reduces to the simple summation of codes of estimates $n_k$ taking into account the signs of the individual orthogonal periodic functions at moments of digitization.

## 3. Hardware Implementation of Analyzer

In terms of its structure, the AS-16 spectrum analyzer represents a combination of parallel- and serial-operation spectrum analyzers [2]. From a single sample of the studied signal, $\{\hat{x}(t_k)\}$, $k = \overline{1, N}$, a determination is made, in parallel in terms of time, of estimates of coefficients for 16 frequency transformation points. At this level the analyzer operates according to the principle of a bank of 16 digital Fourier transform filters. Transformation with a number of points of 16m, where $m = 2, 3, \ldots,$ is performed serially over time. At this level the analyzer operates according to the principle of a swept digital Fourier transform filter. Taking this into account, the structure of the analyzer can be defined as a swept bank of 16 digital Fourier transform filters.

The structural diagram of the analyzer is shown in fig 3. The analyzer has a common data bus whose organization corresponds to the data bus of the "Elektronika 60" microcomputer. The data bus is connected via an interface to the data bus expander of the measuring and computing complex's computer. The analyzer is programmed by means of the computer at the stage of preparing the analyzer for operation. The required sample size is entered into the register of the N counter and the values of the secondary pseudorandom digitization streams, $\{\zeta_k\}$, and quantization streams, $\{\xi_k\}$, are generated in the computer and are entered, respectively, into the unit for assigning $\zeta_k$ and the unit for assigning $\xi_k$ and the values of orthogonal periodic functions $\{R_c(i\Delta f, t_k)\}$ and $\{R_s(i\Delta f, t_k)\}$ are calculated and entered into the unit for assigning values of orthogonal periodic functions.

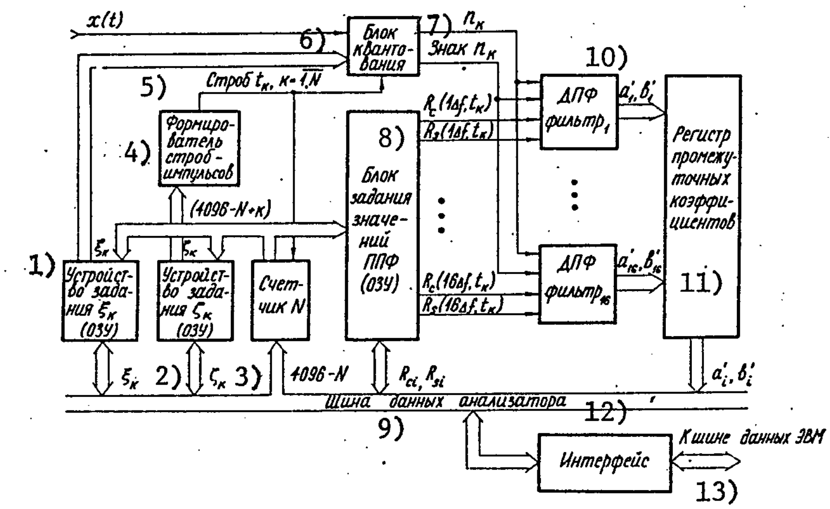



Figure 3. Structural Diagram of Spectrum Analyzer

Key:

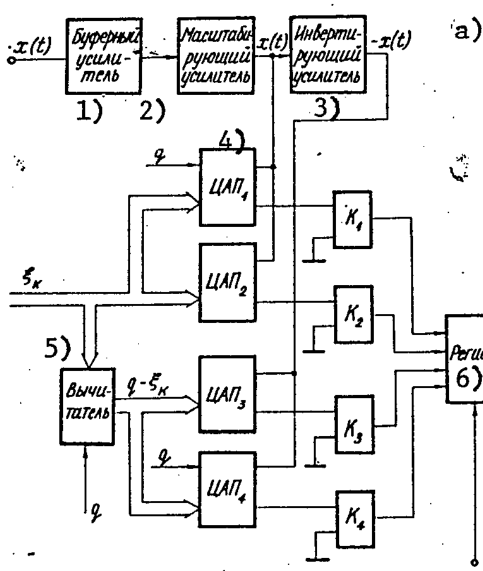
1. Unit for assigning $\xi_k$ (RAM)
2. Unit for assigning $\zeta_k$ (RAM)
3. N counter
4. Gate pulse shaper
5. Gate
6. Quantization unit
7. Sign of $n_k$
8. Unit for assigning values of orthogonal periodic functions (RAM)
9. Analyzer's data bus
10. Digital Fourier transform filter No 1
11. Register for intermediate coefficients
12. Interface
13. To computer data bus

The analyzer operates in the following manner. The signal being studied enters the input of the quantization unit, where at digitization moments $t_k$ a determination is made of the codes of estimates of the studied signal, $n_k$. The instantaneous values of estimates of intermediate coefficients $a_i'$ and $b_i'$ are accumulated in the digital Fourier transform filters according to expressions (3). After selection of the specified sample size, N, the values of estimates of intermediate coefficients are copied into the intermediate coefficient register, after which the N counter and digital Fourier transform filters are reset and a new transformation cycle begins. The values of estimates of intermediate coefficients, via the analyzer's data bus, enter the IVK computer, where in keeping with algorithm (5) a

determination is made of estimates of Fourier coefficients of the studied signal, $a_i$ and $b_i$. These operations are performed while the next sample is being selected; the analyzer's real-time operating mode is implemented in this manner.

A structural diagram of the quantization unit is presented in fig 4a. The buffer amplifier represents a repeater with high input impedance and a low-frequency filter for removing from the studied signal high-frequency components and noise lying in the analyzer's transformation frequency range. The scaler serves the purpose of selecting the transformation range, $[-\chi, \chi]$, as a function of the range of possible values of the studied signal. Digital-analog converters TsAP1 to TsAP4 are used for setting quantization levels taking into account pseudorandom secondary stream $\{\xi_k\}$, whereby TsAP1 and TsAP2 operate in the positive region of values of the studied signal and TsAP3 and TsAP4 in the negative. Digital-analog converters with current output and an internal feedback resistor are used in the analyzer, which makes it possible in performing the operation of comparing the studied signal with quantization levels, to eliminate a single intermediate conversion of current into voltage and at the same time to improve quantization accuracy and the maximum gating frequency of the quantization unit. Comparators K1 to K4 follow the direction of the current in the current output of the individual digital-analog converters, fixing the degree to which the studied signal exceeds the assigned quantization levels. At gating moments $t_k$ the state of comparators K1 to K4 is stored in the register and is decoded by the decoder. The algorithm for determining the code and sign of the estimate of the studied signal as a function of the state of comparators K1 to K4 is presented in fig 4b.

a)




b)

| $K_1$ | $K_2$ | $K_3$ | $K_4$ | Знак $n_k$ | $n_k$ |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | + | 2 |
| 0 | 1 | 0 | 0 | + | 1 |
| 0 | 0 | 0 | 0 | + or − | 0 |
| 0 | 0 | 1 | 0 | − | 1 |
| 0 | 0 | 1 | 1 | − | 2 |

Figure 4. Structural Diagram of Quantization Unit: a--structural diagram; b--algorithm for determining code and sign of $n_k$

[Key on following page]

Key:

1. Buffer amplifier
2. Scaler
3. Inverter
4. Digital-analog converters
5. Subtracter
6. Register
7. Decoder
8. Sign of $n_k$
9. Gate, $t_k$

The amplifiers of the quantization unit are designed on the basis of high-speed integrated operational amplifiers having an output voltage buildup rate of 60 V/μs, which makes possible a transformation frequency range of up to 300 kHz with a dynamic range in the scaler's output of $\pm$ 4.095 V.

The use of integrated digital-analog converters with a short buildup period and comparators with a short cutoff delay period made it possible to achieve a maximum gating frequency of the quantization unit of 1 MHz with a linearity error of not greater than $\pm$ 4 mV.

A structural diagram of the analyzer's digital Fourier transform filter is shown in fig 5. Since the code of the estimate, $n_k$ , can take on only values of 0, 1 and 2, the accumulating adder-subtracter is in the form of a simple reversible counter with the ability to register the counting pulse in the first and second bits. The coder determines the type of operation to be performed in the accumulating adder-subtracter in the k-th digitization cycle. The addition operation is performed when the signs of the estimate of the studied signal and the orthogonal periodic function agree, and the subtraction operation when they do not agree.

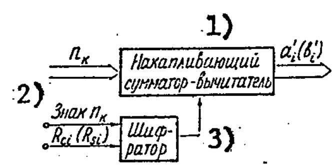



Figure 5. Structural Diagram of Element of Digital Fourier Transform Filter

Key:

1. Accumulating adder-subtracter
2. Sign of $n_k$
3. Coder

The unit for assigning $\zeta_k$ , the unit for assigning $\xi_k$ and the unit for assigning values of orthogonal periodic functions are designed on the basis of RAM units with an organization of 4K 8-bit words. Integrated RAM's of the static type are used in the RAM units, which is a key factor from the viewpoint of enabling operation of the analyzer in real time. The gate pulse shaper forms a stream of gate pulses according to algorithm (7) and represents a converter into a time interval of the codes of pseudorandom numbers $\zeta_k$ constructed on the basis of a preset binary counter.

When using the analyzer as part of an IVK based on small computers of the SM-3 and SM-4 type the analyzer is connected to the computer via an additional interface installed in the computer's data bus expander.

The external appearance of the analyzer is shown in fig 6.

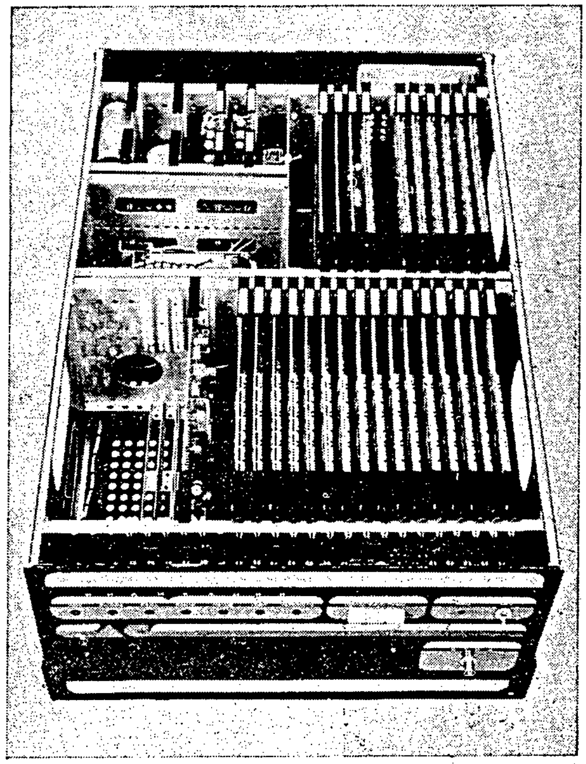


Figure 6. External View of AS-16 Spectrum Analyzer

The analyzer's key specifications are as follows:

Frequency range of studied signal--300 kHz
Maximum dynamic range of studied signal--± 10.24 V
Linearity error of quantization unit--± 4 mV
Sample size--to 4096
Range for assignment of mean digitization frequency--from 610 Hz to 303.03 kHz

The structure and technical implementation of the analyzer afford the investigator the ability to vary over a wide range all key transformation modes and parameters depending on apriori information on the characteristics of the studied signal and the nature of problems to be solved, including the type of orthogonal periodic

function, the mean digitization frequency, parameters of secondary pseudorandom digitization and quantization streams, the sample size, the amplitude and frequency transformation range, the frequency transformation step, the type of spectrum window, etc. The bidirectional data bus makes it possible to make an on-line check of the technical condition of key units and the equipment of the analyzer. The capabilities of the analyzer in various fields of scientific research depend also on the software of the analyzer as part of the measuring and computing complex.

Software in FORTRAN-IV has been created at the Institute of Electronics and Computer Technology of the Latvian SSR Academy of Sciences for using the analyzer as part of the IVK-7 based on a type SM-3 small computer. The software includes two operating programs making it possible to measure amplitudes, phases and spectral power densities of the components of the expansion of periodic and stationary random signals and to statistically process measurement results, as well as two test programs for checking the technical condition of all key elements of the analyzer.

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8831
CSO: 1863/119

DIAGNOSTICS OF TAPE-DRAWING MECHANISM

Moscow DEN'GI I KREDIT in Russian No 1, Jan 82 pp 64-66

[Article by A. V. Akerman, deputy chief of KVTs [Multiple-User Computer Center] MGK [Moscow City Office], Gosbank, A. L. Danilov, senior engineer, KVTs MGK, Gosbank, and V. N. Inozemtseva, machine chief, KVTs MGK, Gosbank: "A Diagnostics Procedure for the LPM-ML (Tape-Drawing Mechanism--Magnetic Tape) System"]

[Excerpt] A high degree of reliability of computer-processed banking data is achieved by means of a thorough monitoring of the entire technological process of problem solution. A rapid output of the findings directly depends on the recovery time of the system following failures and malfunctions. The problem of shortening recovery time is particularly acute with respect to large computational systems of the "banking" type with a low redundancy margin and absence of diagnostic instrumentation.

In such systems, recovery time is nearly completely a function of the experience of the electronics engineer--an experience which takes 3 to 4 years to gain. The search for malfunctions in such systems becomes a kind of art, which is far from accessible to every engineer. A solution of this problem is the automation of the search for the failures and malfunctions of hardware, i.e. the development of diagnostic procedures and test programs that would serve to obtain the complete information needed for repair. The basic requirements for programs of this kind are the accuracy of identification of the site of malfunction and the possibility of the handling of such programs by relatively unskilled personnel. The use of the computer itself for self-diagnosis, i.e. for the search--and in the future perhaps also for the elimination--of malfunctions makes it possible to sharply reduce repair cost and recovery time. The high operating speeds and large memories of present-day computers make it possible to employ procedures based on conducting a large number of tests and scanning a tremendous number of variants that simply could not be performed directly by humans.

One such procedure for diagnosing the errors of tape-drawing mechanisms has been introduced at the multiple-user computer center (KVTs) of Gosbank. The tape-drawing mechanism (LPM) is the principal device in the auxiliary storage of the "Banking" computer complex. It is represented by a low-reliability electro-mechanical device designed for the recording, storage, and readout of information on magnetic tape (ML).

Owing to the low reliability of the LPM-LM system, a three-out-of-six equilibrium code is used to store information and protect it against distortion, but this complicates diagnostics, since information is stored in encoded form on magnetic tape. For example the binary number 4 (binary code 0100) is recorded in magnetic tape storage in the form of its image in the three-out-of six code, i.e. in our example, 110100.



1386
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## AUTOMATED DATA BANK FOR INDUSTRIAL ENTERPRISES, AUTOMATED SYSTEM FOR STATISTICS, LATVIAN SSR

Moscow VESTNIK STATISTIKI in Russian No 2, Feb 82 pp 32-38

[Article by Gunar Andreyevich Baltin', chief of Central Statistical Administration, Latvian SSR, Dayna Teodorovna Dimitre, chief of department, Central Statistical Administration, Latvian SSR, and Vladimir Alekseyevich Silukov, deputy direction, Regional Computer Center, Central Statistical Administration, Latvian SSR]

[Excerpts] An automated data bank (ABD) for industrial enterprises, which comprises part of the ASGS [Automated System for State Statistics] and the functional complex Promyshlennost', Latvian Republic Automated Control System (RASU) has been developed and is being operated at the TsSU [Central Statistical Administration], Latvian SSR.

The ABD is designed for information servicing of the managing organizations of the republic, Latvian SSR Gosplan, ministries and agencies included in the functional complex Promyshlennost', sector departments of TsSU, Latvian SSR, scientific research organizations and other users.

The ABD is used to prepare the retrospective data base for subsequent calculation of future plans at the ASPR [Automated control system for planning calculations], information-reference servicing of users, preparation of information for the managing organizations of the republic, cities and rayons about the course of fulfilling the five-year plan by production associations and industrial enterprises, preparation of topical statistical bulletins containing materials on analysis of the tendencies of economic phenomena over a number of years, conducting dynamic series of indicators of industrial enterprises and maintaining them in a timely state.

For example, when compiling plans for the 11th Five-Year Plan and up to 1990, data was transferred throughout the ministries and agencies of the republic from the ABD to the ASPR on magnetic tape. This made it possible to reduce the periods of compiling the plans and, having developed many versions, to select the optimum one. Statistical bulletins are published on the basis of the ABD.

An experiment was successfully conducted on constructing a dynamic series of basic indicators of industrial enterprises for local organizations of state

statistics. Expansion of the range of indicators of the ABD makes it possible to carry out centralized publication of dynamic series and to eliminate management of them manually.

The information base is constructed with regard to the completeness of display and actualization of storage data throughout the entire observation period, maintenance of their compatibility and dynamic continuity and freeing users of the need to recalculate the indicators for the previous periods with regard to reorganization of industry.

Storage of information in an ABD is organized such that, for example, the indicators for previous periods are recalculated in the automated mode according to the structure existing at the moment the information is issued if the structure of enterprises changes (if a production association is formed on the basis of several enterprises, if an enterprise is attached to a previously created production association and so on). The changes in the names of enterprises and also in their classification features are taken into account in the ABD. Thus, when developing a dynamic series of indicators or other information over a long period, compatibility of data is ensured with respect to the structure and composition of enterprises in a given number of facilities at the moment the information is issued.

The use of an ABD as an information-reference fund made it possible to reduce considerably the time for data retrieval and formulation of reference lists.

Information is stored at the ABD about 327 production associations and independent industrial enterprises of the number of facilities being planned that are located in the republic, regardless of their agency affiliation and regardless of whether the bookkeeping offered by them is processed in a centralized manner (in organizations of state statistics) or in a decentralized manner (at ministries and agencies).

The designation of the ABD required the development of an integrated system of indicators that permit complex analysis of related economic and statistical indicators reflecting the production and financial-economic activity of industrial enterprises. The information base of the observation facility is the main annual bookkeeping and statistical accounts and tasks of the five-year plan.

The data base of the ABD contains more than 130 basic indicators that characterize the production volumes and product sales, production of consumer goods and domestic appliances and goods of economic significance, the quality of products produced, the numbers and wages of personnel, the use of working time, basic funds and circulating funds, basic indicators of technical progress, profits and losses, incentives funds, cost, capital investments and also miscellaneous indicators. Along with the enumerated accounting indicators tors, the data base contains the basic planning indicators of the five-year plan.

The created data base permits one to expand the range of indicators. The number will be increased for the 11th Five-Year Plan with regard to the

requirements of the decree of the CPSU Central Committee and the USSR Council of Ministers dated 12 July 1979 "On improving planning and intensification of the effect of the economic mechanism on increasing production efficiency and work quality."

The basic stored indicators permit calculation of more than 50 derivatives. The data base can be expanded to 800 basic and 200 derivative indicators for one facility. The derivative indicators (labor productivity, return of investment, ratio of funds per worker and so on) are not stored in the ABD. This is explained by the fact that in the case of an association, several enterprises are recalculated as basic and also as derivative indicators dependent on them. The algorithm for finding the derivative indicators is supported in any case by the programs. Accordingly, the derivative indicators can be found as needed by calculation rather than being stored.

The set of indicators now used is essentially taken for the indicators used most frequently in analytical notes and lists presented by sector departments of the republic central statistical administration to managing organizations. The desires of the Latvian SSR Gosplan and Academy of Sciences and also some NII [scientific research institute] are also taken into account.

Besides the indicators that characterize production and financial-economic activity, the ABD contains classification features of the agency, sector and territorial affiliation of facilities. All-Union classifiers of the "System of notations of organizations of the state administration of the USSR and union republics" (SOOGU), "Sectors of the national economy" (OKONKh), "System of notations of facilities of administrative and territorial division of the USSR and union republics and also populated points" (SOATO), "Enterprises and organizations" (OKPO), the local list of "System for describing basic and production indicators" and so on are used for this purpose.

The YeS EVM [unified computer system] with internal storage of 265K bytes, three magnetic disk stores and four magnetic tape stores is required for functioning of the ABD.

The head organization in development and management of the ABD for industrial enterprises is the Central Statistical Administration, Latvian SSR, embodied by the department for development and management of registers of enterprises, institutions and organizations (further, department of registers for brevity). The data processing programs and the technical base for management and operation of the ABD is provided by the regional computer center, Central Statistical Administration, Latvian SSR.



6521
CSO: 1863/153

AUTOMATION OF STRUCTURAL DRAWING WORK IN AUTOMATED DESIGN SYSTEM OPERATING SYSTEM

Moscow NA STROYKAKH ROSSII in Russian No 4, Apr 82 pp 50-53

[Excerpts from article by Yu. Rogov, chief specialist, TsNIIproyekt [Central Scientific Research Institute of Planning], candidate of technical sciences: "Automation of Structural Drawing Work in an Automated Design System Operating System"]

[Excerpts] One of the main ways of efficiently utilizing labor productivity in planning is to accomplish the total automation of drawing and graph making work, which comprises, according to the data of planning institutes, on average 50 percent of all planning work. The ability to solve this problem is based on the existence at the present time of sufficiently perfected computer hardware, including graph plotters.

It is possible to single out two main trends here:

The use of the graphic representation of the results of a computer's work as the most convenient information form for direct interaction (communication) between a human being and a computer in solving various computing problems, including problems in planning.

Automation of structural drawing work aimed at the development by means of a computer of graphic planning information--the chief result of planning.

The second trend, undergoing intense development at the present time, is discussed in this article.

Phase one of the PROMONT graphic operating system has been developed at the present time at the USSR Gosstroy TsNIIproyekt. The system is based on a method, developed at the institute, of multilevel structural simulation and analysis of graphic planning documents. According to this method a drawing is regarded as a complex subject for simulation, as it in fact is.

The structure of a drawing in its natural layout is interpreted by the planner primarily as an organized arrangement of specific integral fragments of planning information (object structure), and not of just simple geometrical elements.

For example, on the framework drawing for a ferroconcrete structure its projections (general types), sectional views and cross sections and written notes, specifications of parts, etc., are placed. Sectional views and plans for buildings, mounting elements of ferroconcrete elements, etc., represent more complex parts of planning documentation. These parts or fragments of drawings are formed here from other component fragments of a lower structural level.

A digital model of a drawing is organized on the computer by the PROMONT system on the basis of the object structure principle in the form of a multilevel hierarchical system of digital data with a unified and strictly ordered form for representing all its elements.

The use of the system makes it possible to develop applied software for forming and producing specific types of drawings while implementing the principles of compositional analysis. In keeping with these principles, the process of forming a digital model of a drawing in its intermediate steps is based on the machine performance of a graphic analysis, which considerably improves the capabilities of applied programs in the area of obtaining from the computer drawings with a high level of readiness.

The structure of the software of the PROMONT system with an indication of the degree of readiness of individual parts in 1981 (phase one) is presented in fig 1 [not reproduced]. The plan is to develop completely and introduce these operating facilities into practice by 1986. Major developments here will involve the organization of a "planner-computer" graphic dialogue for finishing and correcting drawings received from a large computer. These operations are performed manually at the present time.

Using the PROMONT system, the TsNIIproyekt, Goskhimproyekt [State Union Institute of Designing Special Facilities, Buildings, Sanitary Engineering and Power Equipment for Enterprises of the Chemical Industry] and Khar'kov PSNIIP [expansion unknown] institutes have developed an applied program complex making possible the automated execution of various kinds of drawings of industrial buildings.



8831
CSO: 1863/167

## NEW COMPUTER DATA PROCESSING SYSTEM IN PLACE AT ALMA-ATA PLANT

Moscow AVTOMOBIL'NYYE DOROGI in Russian No 12, Dec 81 pp 28-29

[Article by I. P. Lavriyenko and Ye. A. Arkhitektor, engineers: "The Start-Up Complex of the Automated Control System Is Launched"]

[Text] The Alma-Ata Bridge and Reinforced Concrete Construction Elements Production Association of Kazdorstroyindustrii [possibly Kazakh SSR Road Construction Industry Trust] of the Kazakh SSR Ministry of Automobile Roads was formed on the basis of a bridge element plant whose annual capacity is now 84,000 cubic meters of construction elements and whose annual sales volume is 7.2 million rubles for a total assortment of about 400 reinforced concrete and conventional concrete articles and commodity concrete.

The Republic Computing Center of the Kazakh SSR Ministry of Automobile Roads has been working since 1977 on formulation of an automated production control system for the Alma-Ata Bridge Construction Element Plant [AZMK].

The pre-design stages of work and technical-economic substantiation of the system showed that it would be wise to solve the most labor-intensive problems of operational control, accounting, marketing, supply, and technical-economic planning first. Then, based on an improved document circulation system developers moved ahead to automate control of finance-management activities and, finally, solve the problem of optimization of planning, preparation, and regulation of production. A computer program was written to solve each of these problems.

Industrial use of a series of programs began in September 1978, and in 1980 the start-up complex of the first phase of the AZMK automated production control system was begun. The following programs had been prepared:

a. in the subsystem for technical-economic planning — programs to calculate normative costs per unit, normative prime cost of planned and actual production of output, and the normative requirements for materials for the planned production;

b. in the material-technical supply subsystem — a program to keep track of and analyze the availability of scarce materials at the plant;

c. in the subsystem for control of marketing of finished output — programs for operational methods of shipping of finished output;

d. in the accounting subsystem — programs to analyze accounts with customers, debts, use of materials in production, and accounting for material assets;

e. in the operational control subsystem — programs for operational records of the movement of finished output and its production.

Work on setting up and using the reference norms base and standardizing input and output forms preceded industrial use of the above-listed programs.

Problem-solving by computer made it possible to eliminate intermediate storage documents, greatly reduce the time of computation work, and improve its reliability; to receive operational information on the movement of materials and finished output in physical and cost terms and secure operational records of the production of finished output and semifinished products; to receive operational information on the shipment of output; to inform the plant management concerning accounts with customers; to monitor fulfillment of contracts for delivery of output to customers and delivery of materials from suppliers; to calculate the need for materials for the planned period of production of output, and so on.

The economic impact from introduction of the complex was 54,200 rubles a year.



11,176
CSO: 1863/122

IMPROVEMENT OF TELEPROCESSING OF STATISTICAL DATA

Moscow VESTNIK STATISTIKI in Russian No 4, Apr 82 pp 59-65

[Excerpts from article by Galina Viktorovna Smetanina, senior scientific associate, NII TsSU SSSR [USSR Central Statistical Administration Scientific Research Institute], and Mikhail Vladimirovich Prokof'yev, senior scientific associate, NII TsSU SSSR: "Questions Relating to Improving Teleprocessing of Statistical Data"]

[Excerpts] In recent years the USSR TsSU [Central Statistical Administration] system has begun the practical solution of problems relating to teleprocessing of statistical data: The first phases of four collective-use computing centers (VTsKP's) have been put into industrial service, in which the remote access of users to computer resources has been made possible, and the first phase of the ASGS [Automated System of State Statistics] Statistical Data Teleprocessing System (STOSI) has been put into experimental operation on the basis of the hardware and software of the USSR TsSU GVTs [Main Computing Center], the Ukrainian SSR TsSU RVTs [Republic Computing Center] and the republic VTsKP's of the Belorussian SSR and Estonian SSR TsSU's. The data teleprocessing systems of the VTsKP's and STOSI created have been constructed with the use of YeS [Unified Series] computer hardware and software.

Studies conducted at the NII TsSU SSSR make it possible to conclude that it is necessary and possible to develop unified design solutions for the creation and development of teleprocessing systems for the ASGS and VTsKP's. This is especially important under conditions of conversion of computing centers of the USSR TsSU system into collective-use computing centers.

Statistical data teleprocessing has a number of features which distinguish the STOSI from other teleprocessing systems functioning under conditions of VTsKP's. The following are the most important of them: intercomputer information interchange in interaction of computing centers of the USSR TsSU system; access to automated data banks of various levels of the ASGS; interlinking with computing centers of other ministries and departments, e.g., when solving problems within the structure of republic ASU's [automated control systems]; and enabling service communications between users of various computing centers.

These features have been responsible for the necessity of implementing five standard modes of interaction: computer-computer, user station - computer, user

station - computer - computer, user station - computer - user station, and user station - computer - computer - user station. The first mode is used for organizing intercomputer communications in the ASGS; the second for remote access to automated data bank resources of one computing center and the gathering of statistical data from other computing centers through switched communications channels; the third for remote access to a remote automated data bank or for gathering data from other centers when working through unswitched communications channels; the fourth for service communications within the limits of a single computing center; and the fifth between users of different computing centers. Implementation of service communications and remote access to computing center resources in these modes is accomplished on the basis of YeS-computer user stations and display stations.

In solving ASGS problems in the teleprocessing mode, personnel of State Statistical Administration agencies can use user stations and display stations, as well as local display stations or group displays.

In remote access of users to VTsKP resources, as a rule, only the user station - computer mode is implemented with the use of user stations connected to VTsKP computers by means of communications channels and data teleprocessing hardware installed at VTsKP's: modems, data transmission multiplexers, etc. The following teleprocessing modes are shared in common in implementation of the tasks of VTsKP and ASGS users: packet, and interactive, including dialogue and request-grant. The statistical data packet teleprocessing mode is used for gathering and subsequent processing on a computer of statistical reporting data, as well as for solving problems of VTsKP users. On average 70 percent of the total amount of information belongs to its share under conditions of a VTsKP. The "dialogue" mode is used, e.g., for debugging programs, and the "request-grant" mode when working with automated data banks.

An interrelated complex of YeS computer hardware and software is used at computing centers and VTsKP's of the USSR TsSU system. The cost of data teleprocessing facilities for ASGS needs is about 10 percent of the cost of all the equipment of a computing center. The use of a computing center's teleprocessing facilities just for solving ASGS problems is not sufficiently efficient, since in view of the irregularity of the arrival of data their mean 24-hour utilization will be non-total, whereas the changeover to collective forms of using computers and teleprocessing facilities will be conducive to improvement of the efficiency of the use of the STOSI under conditions of the ASGS. Therefore, it can be anticipated that the creation of VTsKP's on the basis of computing centers of the USSR TsSU system will speed the introduction of statistical data teleprocessing facilities. On the other hand, the introduction of the STOSI at computing centers of the USSR TsSU will make it possible to prepare them for a qualitatively new mode of operation--the collective-use mode.

On the whole it is necessary to create according to a common methodology teleprocessing systems at VTsKP's and computing centers of the USSR TsSU system which will solve problems relating to the teleprocessing of both statistical information and information of VTsKP users, a methodology making it possible to develop unified approaches to the design of the hardware and software complex. Primarily, this will make it possible to use common software both for the ASGS and for other VTsKP users. The hardware of users can be different. For example, local display stations

will basically be used for State Statistical Administration agency economists, and remote user stations for VTsKP users. Meanwhile these terminals will be connected to the same VTsKP computers. The architecture of the hardware and software of VTsKP's and computing centers must be unified.

The basis of the design of teleprocessing systems, taking development dynamics into account (growth in number of users and problems solved at computing centers and VTsKP's, expansion of group of services offered, etc.), should be the principle of adaptiveness, in keeping with which it is advisable to create at computing centers adaptive teleprocessing systems with an expandable architecture.

The basis of a system of this class must be a developed computing system making possible the asynchronous performance of teleprocessing processes on the basis of decentralized control of the operation of the elements making it up. Adaptiveness is regarded as the property of a system to rearrange its architecture in keeping with data accumulated on the system's operation and the need to change the conditions and modes of its functioning. Implementation of this principle is achieved by modularity of the design of the system, each of whose modules must be programmable. Adaptive systems make possible the redistribution of the resources of computers formed into a complex within the limits of a computing center or computing network, among various tasks in keeping with some efficiency function (e.g., characterizing the efficiency of data teleprocessing), as well as offering of the system's resources to users taking into account the specific nature of their requirements.

Implementation of these principles of the design of adaptive teleprocessing systems makes it possible to expand their architecture with allowance for a change in the conditions of the functioning of hardware and software, making it possible to improve the system's productivity while at the same time reducing the adjusted annual cost per unit of data processed, with a growth in the load for the computing center or VTsKP and an increase in the number of its users.

The creation of adaptive teleprocessing systems requires solution of the following major problems:

Selection of the optimum technology for implementing processes of teleprocessing the data of users.

Designing data teleprocessing hardware and software taking into account the possibility of broadening the system's scale and group of services offered.

Selecting an algorithm for breaking down teleprocessing tasks, taking into account the specialization of computers at computing centers and VTsKP's and the distribution of functions among them.

Organization of input/output of programs and data, control of resources and protection of data and programs.

Optimization of the productivity/cost ratio while observing reliability requirements.

The most important problem in designing an adaptive system is selection of the optimum technology utilizing to the maximum the capabilities of the hardware and software of computing centers in solving users' problems. It is suggested that the concept of k-phase teleprocessing be introduced for purposes of classifying standard technological processes.

K-phase teleprocessing is based on the sequential execution of procedures by means of k-complexes of hardware and software of each computing center or computing network. From the viewpoint of the k-phase concept, it is possible to distinguish between a single-phase teleprocessing technology implemented on the basis of a single computer linked with communications channels, and a multiphase technology based on multimachine complexes within the limits of a single computing center and computing networks. The process of improving statistical data teleprocessing consists in changing from a single-phase technology to a multiphase. The number of phases is determined according to the algorithm chosen for breaking down tasks, taking into account the specialization of computers in executing specific functions in the data teleprocessing system, such as reception/transmission, control of teleprocessing processes, switching, and direct processing of data. For example, a 3-phase technology is possible whereby the first computer solves only problems of switching and gathering data, the second computer problems of interactive teleprocessing in the time sharing mode in combination with control of the users' network, and the third computer, problems of packet data teleprocessing.

Each of these variants has its advantages and disadvantages. The single-phase technology does not make it possible to automate at a high level teleprocessing control processes, which reduces the effectiveness of utilization of computer resources. Therefore, its implementation is advisable with small amounts of computing work on a computer of average productivity and with limited resources (a YeS-1022, YeS-1030 or YeS-1033), or when processing large amounts of data on a computer of high productivity and with a working storage capacity of several megabytes (YeS-1045, YeS-1050 or YeS-1060). The multiphase technology makes it possible to solve these problems and is more reliable, which makes it possible to utilize all the advantages of distributed operating systems (ROS's) enabling functioning of a multimachine complex of Unified System computers, and it can be implemented with computers of average productivity having fewer resources, e.g., a YeS-1033 or YeS-1035.

Let us discuss variants of the design of data teleprocessing systems under conditions of multimachine computer complexes (fig 1). With variant a) the single-phase data teleprocessing technology is implemented on the basis of a single computer having an external memory field with another computer. This variant is the basic one for existing VTsKP's. Each machine operates independently of any other, specializing in solving a specific class of users' problems in the teleprocessing mode. If one computer fails the data transmission multiplexer switches to another computer. The required peripheral units can be switched by means of two-channel switches. Also an example of the single-phase technology is the system for gathering and packet teleprocessing of statistical data through telegraph communications channels implemented at the RSFSR Central Statistical Administration Republic Computing Center, using a "Minsk-32" computer.

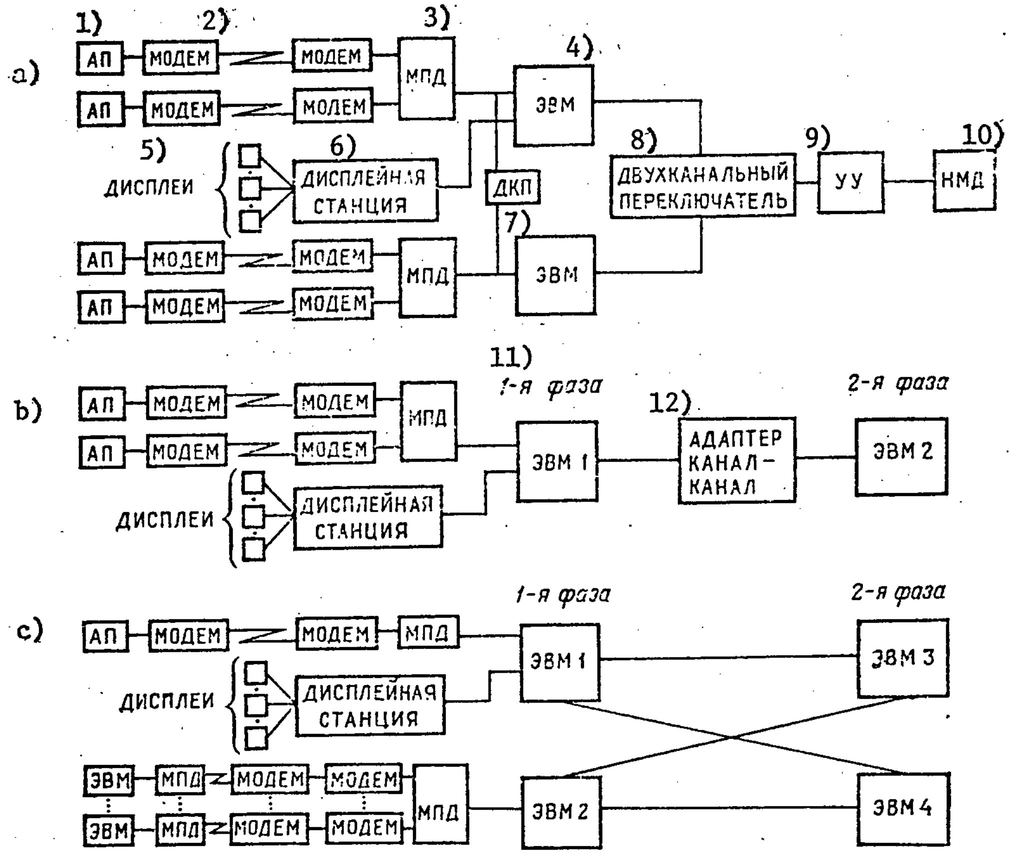


Figure 1. Variants of Design of Data Teleprocessing Systems Based on YeS Computer Hardware and Software

Key:

1. User station
2. Modem
3. Data transmission multiplexer
4. Computer
5. Displays
6. Display station
7. Two-channel switch
8. Two-channel switch
9. Control unit
10. Disk storage
11. First phase
12. Channel-channel adapter

The k-phase data teleprocessing technology is implemented in variants b) and c). The first computer, for example, gathers statistical data and the second directly processes it by means of electronic data processing complexes (KEOI's). The machines are linked together via adapters of the "channel-channel" type. Variant b) is based on centralized input/output of data through communications channels and variant c) on a decentralized solution to problems of remote input/output of data. For example, one computer of the first phase in variant c) specializes in interaction of users with a VTSKP in the user station - computer mode and the second in intercomputer communications with other computing centers and VTsKP's of the USSR

TsSU system. KEOI problems are solved on the computer in the second phase, etc.

Successful functioning of a multicomputer complex in implementation of the multiphase technology is possible under the control of a distributed operating system. Work on its mastery is being performed at the Estonian SSR Central Statistical Administration Republic VTsKP.

Designing adaptive teleprocessing systems on the basis of the computing centers of the USSR TsSU system allowing for the dynamics of their development makes it possible to improve the architecture of the computing system without its radical restructuring by changing to the multiphase teleprocessing technology within the limits of a single computing center or of the computing network as a whole.

Let a teleprocessing system implementing the 2-phase technology and based on the use of series-connected computers, as illustrated in fig 1b and 1c, service two message streams. Let us assume that the first stream represents messages to be processed in the interactive teleprocessing mode and the second in the packet mode. Here, as a rule, the length of messages in the interactive mode is 100 to 1000 characters and in the packet mode thousands and dozens of thousands of characters.



8831
CSO: 1863/169

UDC 658.5.012.011.56:666.94.001:65.011.56

# REPEAT IMPLEMENTATION OF AUTOMATED PRODUCTION PROCESS CONTROL SYSTEMS IN CEMENT INDUSTRY

Leningrad TSEMENT in Russian No 3, Mar 82 pp 6-7

[Article by engineers I. B. Ginzburg and V. V. Smirnov, engineers, "Soyuzavtomatstrom" All-Union Scientific Production Association]

| (1) АСУТП | (2) Характеристики комплекса технических средств КТС | | | | | (10) Ориентировочные затраты, тыс. руб. | | | | | | Ориентировочный экономический эффект, тыс. руб./год | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (3) Емкость оперативного запоминающего устройства ОЗУ | (4) Число входов | | (7) Числов выходов | | (11) Всего | (12) в том числе | | | | | (19) | |
| | | | | | | | | | (15) на проектирование | | | | |
| | | (5) аналоговых | (6) дискретных | (8) непосредственное цифровое управление НЦУ | (9) дискретных | | (13) на оборудование | (14) на строительно-монтажные работы | (16) техническое обеспечение | (17) программное обеспечение | (18) на внедрение | (11) Всего | (20) В том числе за счет снижения себестоимости |
| (21) Мокрого измельчения сырья[1] | 16K | 40 | 50 | 20 | 6 | 375,0 | 180,0 | 50,0 | 30,0 | 75,0 | 40,0 | 88,0 | 30,0 |
| (22) Помола сырья в мельницах с сепараторами воздушно-проходного типа и сушкой отходящими газами печи[2] | 16K | 36 | 24 | 14 | — | 220,0 | 120,0 | 25,0 | 15,0 | 30,0 | 30,0 | 110,0 | 70,0 |
| (23) Приготовления цементной сырьевой смеси заданного химического состава по порционной и полупоточной технологии[3] | 10K | 7 | 18 | — | — | 220,0 | 130,0 | 20,0 | 15,0 | 30,0 | 25,0 | 90,0 | 25,0 |
| (24) Приготовления цементной сырьевой смеси заданного химического состава по поточной технологии при сухом способе[4] | 20K | 10 | 32 | 12 | 8 | 390,0 | 250,0 | 40,0 | 15,0 | 60,0 | 25,0 | 300,0 | 120,0 |
| (25) Обжига сырьевой смеси в печах размером 5×185 м мокрого способа с колосниковыми холодильниками[5] | 32K | 56 | 28 | 9 | 2 | 250,0 | 140,0 | 20,0 | 15,0 | 20,0 | 20,0 | 78,0 | 30,0 |
| (26) Помола цементной шихты в мельницах открытого цикла[6] | 8K | 36 | 78 | 24 | 120 | 198,0 | 96,0 | 18,0 | 18,0 | 36,0 | 30,0 | 71,5 | 18,0 |
| (27) Помола цементной шихты в мельницах замкнутого цикла, оснащенных сепараторами с выносными циклонами[7] | 20K | 76 | 68 | 32 | — | 330,0 | 190,0 | 40,0 | 20,0 | 40,0 | 40,0 | 150,0 | 60,0 |

1 For ASUTP for five operators.

2 Per production line with two units.

3 For ASUTP of plant of wet method with productivity up to one million tons.

4 Per production line, including continuous monitoring chemical composition and automation of sampling and delivery of samples.

5 Per unit.

6 Per six units.

7 Per four units using devices for continuous monitoring of fineness of milling.

[Key on following page]

Key [Continued from preceding page]:

1. Automated production process control system
2. Characteristics of hardware complex KTS
3. Capacity of internal storage OZU
4. Number of inputs
5. Analog
6. Digital
7. Number of outputs
8. Direct digital control NTsU
9. Digital
10. Approximate expenditures, thousand rubles
11. Total
12. Including
13. For equipment
14. For construction and installation work
15. For planning
16. Hardware
17. Software
18. For introduction
19. Approximate saving, thousand rubles per year
20. Including those due to cost reduction
21. Wet pulverization of raw material
22. Milling of raw material in mills with air-through type separators and drying by exhaust gases of furnace
23. Preparation of cement raw mixture of given chemical composition by batch and semi-continuous technique
24. Preparation of cement raw mixture of given chemical composition by continuous technique with dry method
25. Roasting of raw mixture in furnaces measuring 5 X 185 meters of wet method with grate cooling units
26. Milling of cement charge in open cycle mills
27. Milling of cement charge in close cycle mills equipped with separators with extensible cyclones



6521
CSO: 1863/153

## SPECIALIZED MINICOMPUTERS USED IN AUTOMATION OF ACCOUNTING OPERATIONS

Kiev RABOCHAYA GAZETA in Russian 18 Mar 82 p 2

[Article by A. Skopenko, chief of Main Administration of Bookkeeping and Accounting, Ukrainian SSR Ministry of Construction Materials Industry, and M. Severinovskiy, chief designer of Project, Planning-Design Office, Scientific Research Institute of Construction Production, Ukrainian SSR Gosstroy, Kiev: "Minicomputers Carry Out Accounting"]

[Excerpts] The planning-design office, Scientific Research Institute of Construction production, Ukrainian SSR Gosstroy, jointly with Ukrainian SSR Minpromstroy [Ministry of the Construction Materials Industry], had developed and introduced a system for automation of accounting operations using specialized minicomputers--Iskra-554 electronic bookkeeping machines--at the UPTK [Administration of Production and Technological Makeup], Kombinat Vinnitspromstroy. The system keeps a record of the arrival, storage and issue of materials from warehouses, issues goods-transport bills of lading according to 10-day and daily makeup schedule per brigade and issues lists of the presence of materials at warehouses, arrival and issue of materials and also disruptions of normative storage reserves of materials and articles.

The annual saving from using the system for automation of accounting operations at UPTK of the Kombinat Vinnitspromstroy comprised approximately 50,000 rubles.

It is planned to introduce an additional 8-10 similar systems in the UPTK of Ukrainian SSR Minpromstroy during the current five-year plan.

6521
CSO: 1863/153

MINISTRY OF TRADE AUTOMATION: ELEKTRONIKA 100-25 APPLIED

Moscow SOVETSKAYA TORGOVLYA in Russian No 3, Mar 82 pp 10-13

[Article by A. Pol'kin, director, ASU [automated control system] division, USSR Ministry of Trade, and V. Bobolev, director, ASU and computer technology division, RSFSR Ministry of Trade: "ASU's to Be Developed"]

[Excerpts] In the 10th Five-Year Plan period work on the creation of ASU's in State trade was performed in keeping with programs approved by the USSR State Committee for Science and Technology and the USSR Gosplan, the coordination plan for the development and introduction of ASU's and computing centers approved by the USSR Ministry of Trade, and the national economic plans of Union republics. The plan quotas were successfully fulfilled. The great organizing work done by the USSR Ministry of Trade and the ministries of trade of Union republics and the socialist competition conducted under the direction of the central administration of the Scientific and Technical Society for Trade, in which scientific research and planning organizations and computing centers took part, contributed to this. An effective method of relaying advanced know-how in organization of the work of computing centers and increasing the efficiency of their work was the all-Union competition for the best computing center of the sector. From the results of 1980 the data processing and computing center of the Moscow Gorispolkom Central Trade Administration was recognized as the best.

In the 10th Five-Year Plan period the USSR Ministry of Trade together with the USSR Gosplan approved a list of base sites for the creation of ASU's, on which physical and financial resources and the efforts of planning organizations were concentrated. The progress of work at base sites was supervised and coordinated by a steadily active work group under the leadership of the Soyuztorgsistema [expansion unknown] All-Union Association. In 1976-1980 trade received a rather large number of third-generation Unified Series computers. This considerably increased the production capacities of computing centers in operation and newly created. The number of functioning ASU's and of functional problems solved within their framework and the range of user organizations increased at an unprecedented pace. While the number of computing centers increased approximately 1.5-fold, the number of operating ASU's increased fourfold and the number of problems solved sixfold. The introduction of ASU's has improved the results of the economic and financial operations of trade. The savings plan was overfulfilled in the 10th Five-Year Plan period on account of the introduction of computer technology.

Computing centers and ASU's are now operating at all levels of management--from the USSR Ministry of Trade to retail and wholesale trade and public food supply enterprises.

At the end of the 10th Five-Year Plan period a number of jobs relating to the creation of ASU's were awarded medals and certificates at the Exhibition of Economic Achievements. The winners include the ASU for control of trade of the Gor'kovskaya Oblast ispolkom and the ASU's of the Beltorgodezhda [expansion unknown] Vitebskaya Oblast center and the Belgalantereya [Belorussian Republic Office for Wholesale Trade in Haberdashery] Minsk wholesale center. Awards were given both to developers of systems and to the most active practical workers in trade. Other effective examples of the creation of ASU's and individual functional subsystems should also be pointed out. They include the ASU at the Ukrainian Wholesale Footwear Market, the ASU complex in the Leningrad Gorispolkom Central Trade Administration system, the "Promtorg" ASU in the Lithuanian SSR Ministry of Trade system, and the ASU of the Mosprodsnab [Foodstuffs Supply Office] of the Moscow Gorispolkom Central Administration of the Public Food Supply. The "Bookkeeping" and "Control of Financial Operations" subsystems developed by RosASUTproyekt [expansion unknown] for the level of a trading organization have become widespread, including at the computing center base of the TsSU [Central Statistical Administration]. The efficiency of the "Control of Transportation" subsystem developed by the Soyuztorgsistema All-Union Association for the OASU [automated control system for an industrial sector] of the USSR Ministry of Trade is high. An entire series of forecasting and optimization planning tasks is being successfully utilized within the framework of the OASU of the USSR Ministry of Trade and the ASU's of the ministries of trade of the Ukraine, Belorussia and Kazakhstan. The design of the ASU for the Bryansk Wholesale Center developed by the Soyuztorgsistema All-Union Association is being used now in creation of ASU's for the wholesale centers in Krasnodar and Minsk. Problems relating to keeping accounts for goods sold to the public on credit are being solved in practically all ASU's for trade on the oblast level and trading organization and department store level. This has drastically reduced overdue debts with a considerable reduction in the input of manual labor for data processing.

A new trend in the introduction of computer technology in management was represented by the creation of the Voronezhskaya Oblast On-Line System for Control of State trade (OSUT). From the technical viewpoint this system is interesting in that for the first time in the sector it uses "Elektronika 100-25" fourth-generation minicomputers, radio communications equipment, modems and displays for data teleprocessing. The Voronezhskaya OSUT is highly efficient and is deserving of broad use. Its development represents a good foundation for the creation of combined and intersector ASU's for trade at the oblast level.

It is necessary to dwell on how the introduction of ASU's has influenced the number of management apparatus personnel and the cost of supporting it.

According to the methodology of the USSR Ministry of Finance, the costs of computer data processing for the management apparatus are planned and accounted for within the framework of appropriations for supporting this apparatus. Such appropriations are severely limited and there are strict punishments for overspending them. In addition, the engineering and technical personnel of computing centers also belong

to the management apparatus, which creates repetitive accounting. Financial agencies require that a growth in the amount of computer data processing be produced without increasing established limits, i.e., on account of a reduction in the number of management apparatus personnel and the cost of supporting it. In addition, these limits, introduced before the extensive introduction of computer technology into trade, are lowered from year to year.

The inadequacy of the limits and the very fact of limiting these expenditures have not only seriously retarded the introduction of modern computer technology into trade, but sometimes make it necessary to reduce the volume of problem solving already achieved, including with the equipment base of machine accounting units of the TsSU system, and have made necessary the centralized planning of even small measures, in terms of operating costs, relating to the new introduction and circulation of ASU tasks. There has been much talk for a long time about the need to change the methodology of planning and accounting for the cost of computer data processing, but nothing has changed.

It can be said that the introduction of data processing with computers does not have to result automatically in a reduction in the number of management apparatus personnel, since this number is determined by a non-optimum method. Quotas for the reduction of personnel and the cost of supporting them are set also in cases when equipment is not introduced. In addition, the possible savings from reducing personnel may not cover additional costs for data processing by means of computers. The lack of a system of material incentives for management apparatus personnel for performing a greater amount of work with a reduction in the number of workers is also not conducive to the development of potential.

The main point is that the main goal of introducing an ASU is to improve the quality of management under conditions of a steadily increasing load on management personnel and, as a consequence, to achieve a considerable increase in the economic and social effectiveness of the sector's work while stabilizing the absolute and reducing the relative (with respect to the amount of work) number of management apparatus personnel. But it is simply impossible to raise to a higher level conforming to modern requirements the quality of management and the productivity of management labor without increasing the equipment/worker ratio of the management apparatus and without appropriate expenditures.

In order to improve the organization of the creation of ASU's and to improve the efficiency of trade on the basis of introduction of computer technology into management, it is necessary to disclose, analyze and eliminate the shortcomings and objective difficulties which accompanied these processes in the last five-year plan period.

In the majority of cases the insufficient efficiency of an ASU is predetermined at the very start of the work. Not infrequently the managers of organizations--ASU customers--assume that it is sufficient to conclude a contract with the planning organization, order a computer, appoint a computing center director, and to entrust the organization of work to one of the subdivisions of its apparatus, most often the bookkeeping department, and the question of creating an ASU is practically solved. All that is left is to wait for the certain positive results. The

viewpoint is also current that if the electronic equipment is acquired and five to 10 skilled planners are invited, then in a year and a half a different system will be created without the participation of planning organizations and, what is more, almost without the participation of the manager.

Here they forget or do not know that the process of planning, introducing and operating an ASU requires the constant and active participation at all stages of creation of the ASU of those subdivisions of the management apparatus for which problems will be solved, and especially of the organization's first-level manager. At those sites where managers do not pay the proper attention to the creation of the ASU there will be no savings from its introduction and it is better not to waste money on expensive equipment. It is necessary for the ministries of trade of Union republics to approach more strictly the selection of sites for the creation of ASU's.

The effectiveness of an ASU depends on the quality of its design and the ability to implement practically the advanced solutions on which it is based. However, still not all designs meet modern requirements because of a surface predesign examination of the subject for automation and the lack of clear criteria for choosing the list of tasks and the specific results to be expected from their introduction. As a result, in use it is extremely complicated to determine the level of satisfaction of the customer's wishes and, accordingly, the savings. This is the result on the one hand of the still inadequate skills of some developers and on the other of the formal attitude of customers toward the work at the design stage and the stage of preparation of the site for introduction. Often this situation results in the need to considerably modify the design and in additional expenditures and drags out the period of introduction.

It must be said, however, that a considerable additional burden is placed on the majority of customers who actively take part in the creation of an ASU, and this work should receive not only psychological, but also material incentives. In our opinion, in order to improve the organization of work on the creation of ASU's and to strengthen the relationship between the evaluation of the work of designers, customers and their computing centers and the efficiency of systems introduced, it is necessary to extend the effect of the "Statute Regarding Rewards for the Introduction of New Equipment" (in connection with the introduction of ASU's) to personnel of the ministry of trade apparatus of Union and autonomous republics, trade and public food supply administrations of oblast, kray and city ispolkoms, sector planning and technology organizations and computing centers.

There is still unutilized potential in the operation of computing centers. At some of them computers are systematically not fully utilized, the amount of work relating to the industrial utilization of tasks is being extended slowly, and they are unnecessarily absorbed in their own developments and various types of modernization of projects. Business contract relations with customers are being introduced at an inadequate tempo, although often this is related to the absence at them of limits for maximum appropriations. Hitherto there is no procedure for organizing cost accounting for computing centers. A shortage of punched cards, edge-perforated paper tape and inked ribbon has extremely interfered with the normal operation of computing centers and MSS's [machine calculation stations]. The introduction of efficient multiprogram computer operating modes and the use of

operating systems have been restrained by a shortage of data input/output units, displays and large-capacity disk storages. There are still few systems in the sector for preparing data on magnetic data media and few data teleprocessing units and communications channels. New automatic bookkeeping machines of the "Iskra-554(IV)" and "Iskra-555" type, which are necessary for solving problems of merchandise flow at wholesale and retail centers, will begin to enter the trade sector practically only as of this year. And planning and trade organizations still do not have microcomputers. In order to improve the operating reliability of computing equipment at computing centers, MSS's and MSB's [machine calculation bureaus], it is necessary to improve the quality of servicing and repair by organizations of Soyuzschettekhnika [expansion unknown] and Soyuzspetsavtomatika [expansion unknown].

The operations of sector planning and technology organizations also require improvement. It is necessary to shorten development time and reduce the cost of projects and to strengthen the coordination of project work between the Soyuztorgsistema All-Union Association, RosASUTproyekt, Ukrtorgsistemotekhnika [expansion unknown] and Beltorgsistema. The sector goods classifier, unified forms of documents and mathematical economic models are being developed at an insufficient pace. It is to be especially noted that it is advisable to entrust only to specialized sector organizations the development of ASU projects designed for wide circulation with performance of the necessary modernization and tailoring to needs.

In the 11th Five-Year Plan period planning organizations and the ministries of trade of Union republics must create new and introduce already existing classifiers of technical and economic information (TEI) and unified forms of documents taking into account the new and stricter requirements for them on the part of the USSR Gosstandart [State Committee for Standards], USSR Gosplan and USSR Central Statistical Administration, which permit the use only of all-Union TEI classifiers in the exchange of information between sectors.

In order to increase the effectiveness of ASU's in trade it is necessary to improve the use of existing computer technology and to replace the obsolete equipment of computing centers with new equipment. A rather large number of obsolete and aged computers of the "Dnepr", "Minsk-22", "Minsk-32", etc., type are being used at many of them. The coexistence of these machines with computers of the "Ryad" series does not make it possible to totally unify software and the problem solving process, requires excess service personnel and does not make possible the required operating reliability for an ASU. Therefore, it is necessary to replace them with computers of the "Ryad" series, and where the amount of information is not too great, with minicomputers of the "SM-4" type. Planning organizations must closely study the possibility of using mini- and microcomputers for decentralized data processing at the largest trade and public food supply enterprises and of creating on this basis regional computing networks with large-capacity central computers.

Expansion of the functional capabilities of data processing at computing centers will be aided by the introduction of operating systems, data bank software, multiprogram and dialogue computer operating modes with displays and remote terminals, equipment for preparation of data on magnetic media and new automatic bookkeeping machines of the "Iskra-554" and "Iskra-555" type, which are essentially mincomputers. It is necessary to utilize to the maximum capabilities for improving the

total data processing technological cycle brought about by the conferring of legal validity on documents on magnetic and paper data media.

Computing centers with the support of planning organizations must steadily improve processing technology and achieve the maximum possible net utilization of computers for increasing the number of problems solved and organizations served while reducing the unit cost of data processing. It is necessary to study more deeply and to introduce the working know-how of leading computing centers of the sector, in particular, the organization of cost accounting and socialist competition.

In the 11th Five-Year Plan period it is proposed to improve and create more than 100 ASU's at various management levels of trade and the public food supply. It is planned to create ASU's for technological processes and to use computers in scientific research and in the education process at VUZ's. Realization of all the objectives designated with respect to the creation of ASU's will make it possible to gain a savings during the five-year plan period of about 40 million rubles on account of improvement of the economic and financial operations of organizations and enterprises of the USSR Ministry of Trade.



8831
CSO: 1863/165

UDC 681.3.06

AUTOMATED INVESTIGATOR WORK SITE

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 82 (manuscript received 5 Mar 80) pp 104-107

[Article by A. P. Kazantsev, Pushchino, Moscow Oblast]

[Excerpt] The concept of the automated work site (ARM) has been finding ever wider distribution recently. Automation of the labor of scientific workers and engineers--in general of investigators involved in scientific experiments and development and testing of new equipment--is of important significance. The automated investigator work site should be its specifics provide remote control of the objects of investigation, should automate routine data gathering operations, should make calculations and should present processed data in a form convenient for review. The automated investigator work site (ARMI) is required to increase the labor productivity of the investigator in controlling the experiment, processing the data and mathematical modelling.

The ARMI based on a minicomputer in small configuration is presented in our article for automation of a small scientific experiment of a general physics nature. A standard CAMAC interface is used in the proposed ARMI system as the general-purpose input-output channel. The CAMAC modules provide communication of the ARMI with the object of investigation and frequently provides communication of the ARMI with the investigator himself. Due to the broad nomenclature of modules and the flexibility of the CAMAC structure, there is the capability of adapting the ARMI to any research problem [1].

The main element of the programs in our system is the high-level language interpreter that provides interaction and the greatest convenience for the user who has no professional training in programming. It is known that high-level language interpreters (for example, BASIC) found wide application in systems based on individual microcomputers [2].

An effective means for the user to communicate with the computer is machine graphics. The recorded and processed experimental data are displayed in graphic form most convenient for human perception. The results of modelling are also presented in graphic form. And on the other hand, graphic information can be entered in the computer in coded form. Our ARMI has a graph plotter and also an interactive graphic display. Interaction of the graphic and language interpreter provides operation of the ARMI in dialogue mode.

The developed ARMI is designed on the basis of M400 computer from a number of program-compatible small computers of the SM EVM [International small computer system] series. To this series is added the Elektronika-60 microcomputer. The given ARMI is realized on the basis of the M400 UVK complex with memory of 16 Kbytes. The UVK is expanded due to the alphanumeric display, one CAMAC crate, a digital graph plotter and a point graph display based on an ELT [cathode-ray tube] measuring 16 cm along the diagonal. The graph plotter and graph display are controlled by CAMAC modules.

Along with the hardware, an important part of the ARMI is the dialogue system DS of the SM EVM (henceforth DS) [3], which is a FOKAL high-level language interpreter. Since FOKAL is a problem-oriented language, the user programs stored in the computer memory realize algorithms developed for their own purposes by the investigator, edited and executed in the dialogue mode during a single process. Since interpretation considerably slows down the passage of programs for some processes (specifically, to control the CAMAC modules), additional programs written in Assembler and executed directly in codes must be used. These program modules are built into the dialogue system in the form of additional FOKAL language functions, summoned by the program to be interpreted the same as standard language functions. The additional functions receive their own names and, thus being fully included in the dialogue system, expand and adapt it to a given application. There is the capability of access to standard functions and subroutines of the dialogue system at the level of Assembler programs for developing additional functions in the dialogue system.

Besides user programs and additional functions, the dialogue system itself requires only 5.6 Kbytes of the total computer memory. This property, along with the brevity of writing the user programs and some other special properties of the dialogue system, advantageously distinguishes it, for example, from the M400 BASIC interpreter, which also predetermined selection of the dialogue system as the main software of the ARMI.

Standard control functions of the CAMAC modules, special control functions of the graphic device controllers and also experimental data manipulation functions are included in the dialogue system in our ARMI system. This system of functions is a developed system. The basic ARMI functions occupy 1,708 bytes of the internal storage.

A data buffer to which files are written in single-word integer format (word length of 16 bits) is allocated to record experimental data in the internal storage. There is a capability of changing the size of the buffer depending on the maximum length of the data files. Data are entered in the buffer by the control functions of ATsP [alphanumeric printer] modules, input registers and so on.



6521
CSO: 1863/134

COST ESTIMATING BY COMPUTERS

Alma-Ata NARODNOYE KHOZYAYSTVO KAZAKHSTANA in Russian No 10, Oct 81 p 62

[Excerpt from article by G. Zemlyankin, cost estimating division director, Kustanaygorsel'proyekt State Planning Institute: "Computers in Cost Estimating"]

[Excerpt] Cost estimating documentation, of course, is the basis for financing construction. Therefore, improvement of its quality has acquired first-rank importance.

The requirements of regulations and instructions now in effect, as well as the great amount of information relating to the use of new materials, structures and parts and to the introduction of the most efficient technological production processes, have considerably complicated development of documentation at the detail (contractor-detail) design stage. In connection with this and with the increased amount of cost estimating work, the necessity has arisen of making more extensive use of modern computer technology and machine methods of data processing.

At the Kustanaygorsel'proyekt [expansion unknown] institute the preparation of cost estimating documentation has been performed for many years on a "Minsk-32" computer by means of the AVS-1a and AVS-2 programs developed by KazpromstroyNIIproyekt [Kazakh Industrial Construction Scientific Research Institute of Planning]. The new improved AVS-3 program is being used at the present time. It differs from the previous ones in that with the present data and specifications base it makes it possible to perform operations relating to producing cost estimates, selecting labor and material resources and tying YeRYeR [unified district individual estimate] catalogues into local construction conditions.



8831
CSO: 1863/167

UDC 681.324

# BASIC DIRECTIONS FOR CREATION OF TIMESHARING COMPUTER CENTERS IN UkSSR IN 1981-1985

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 1, Jan-Mar 82 (manuscript received 28 Jul 81) pp 4-7

[Article by Doctor of Economic Sciences M. T. Matveyev]

[Excerpt] The theoretical foundation for creating a network of computer centers was laid on a national scale by Academician V. M. Glushkov more than 10 years ago. But the real possibilities and traditions for creating Soviet timesharing computer networks on an industrial basis did not begin to appear until the end of the 10th Five-Year Plan. A number of ministries and departments conducted the scientific research and the experiments on a limited scale, to meet the needs of particular sectors as a rule.

The State Committee for Science and Technology began planning the State Network of Computer Centers (GSVTs) back during the 10th Five-Year Plan. But for the moment the rate at which this plan is being implemented is still low.

During the 10th Five-Year Plan a number of ministries and departments of the Ukrainian SSR did some work to create departmental networks of computer centers. The most significant advances in this effort included the Ukrainian SSR Gosplan's State Computer Center's creation of the grounds for and development of the primary planning documents to support creation of a republic network of computer centers (RSVTs) as a component of the GSVTs, and organization of an experimental three-unit network of computer centers (RSVTs nuclei) bringing together the computer of the Ukrainian SSR Gosplan's Main Computer Center, the Republic Computer Center of the Ukrainian SSR State Statistical Administration and the computer center of the Ukrainian SSR Gossnab and providing for computer interchange of data via special communication lines at a rate of 2,400 baud, and mutual (shared) use of computer, information and programming resources.

There are plans for developing the Ukrainian SSR RSVTs further in the current five-year plan. This system is to include the three-unit network, perfected and raised to a level permitting industrial operation, and multiunit departmental (based on the main computer centers of the ministries and departments) and territorial subnetworks (based on oblast computer centers of the Ukrainian SSR State Statistical Administration) connected to it. In turn, not less than half of the main computer centers of the ministries and departments will make up the sector

computer networks, which will represent the sector-wide base level of the RSVTs. Gradually, units of the territorial RSVTs network will be linked to the RSVTs.

Thus, from a topological standpoint the RSVTs is a certain nontrivial hierarchical structure with a polycentric apex, with strongly developed vertical ties between elements at all levels and with nascent horizontal ties, mainly between elements of the territorial network and the base units of the sector subnetwork.

Thus in the end, the RSVTs will have a spider web structure--one of the most complex but the most reliable in operational respects. This structure is essentially the direct product of the existing structure of organs controlling the national economy of the Ukrainian SSR, in behalf of which automated systems for collecting and processing information based on the appropriate computer centers are being created.

On the whole such a structure is also sensible in terms of stability. It can ensure normal operation of a system of control organs organized according to both the sector and the territorial-sector principle. Naturally as this network develops, certain units will be merged or abolished, but this should not have an effect on the viability of the network as a whole.

The most important element of the RSVTs--the data transmission system (SPD)--is to be built by laying broad-band cables between units of the network nuclei and special telephone cables between the State Computer Center and the main computer centers of the major ministries and departments, and using allocated telephone channels between the units of the territorial subnetwork.

It will be impossible to include a number of computer centers (so-called non-network computer centers) into the composition of the RSVTs during the present five-year plan for a number of reasons (mainly having to do with resource availability). The sole correct approach (in relation to non-network computer centers) is to orient these computer centers toward functions of an organizational and technical nature preparatory to their inclusion into the network, to include organization of the exchange of data and programs with other (network and independent) computer centers using magnetic tape.



11004
CSO: 1863/140

UDC 681.3

EXPERIMENTAL THREE-UNIT NETWORK OF COMPUTER CENTERS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 1, Jan-Mar 82 (manuscript received 8 Jun 81) pp 51-52

[Article by Candidate of Technical Sciences L. K. Golyshev and engineers Yu. G. Zhelyabovskiy, T. V. Kuznetsova, V. A. Ryabokon' and V. A. Shonin]

[Text] The ETSVTs (experimental three-unit network of computer centers), which brings together the computer centers of the main interdepartmental organs of control, is the pilot complex of the Ukrainian SSR Republic Network of Computer Centers. The main purpose of the ETSVTs is to support automated interaction of the combined computer centers, which are the technical base of the appropriate OASUs [sector automated control systems]. In its initial stage, the ETSVTs's functions will involve experimental perfection of: the procedures of intercomputer exchange of information via allocated communication lines at moderate and high speeds; the methodology of solving problems associated with interaction between computer centers within the network and practical testing of the methods of control; the procedures of message switching and their practical testing using series-produced technical resources of the YeS EVM [Unified System of Electronic Computers] and SM EVM [System of Small Computers], and checking the effectiveness of the methods used to exchange computer capacities during periods of peak loads on the combined computer centers.

The pilot complex of the ETSVTs consists presently of the existing output capacities of the computer centers serving as units of the ETSVTs, of specially built and allocated communication channels, and of additional teleprocessing resources with which computers at the units are additionally furnished (MPD-3s outfitted with two SA-2 synchronous adapters to which YeS-8010 modems are connected).

To support interaction between computers, the ETSVTs foresees operational communication between console operators at the three units as well as operational communication of the corresponding operators with technical services and subdivisions whose problems are solved by computers having intercomputer ties. Service calls between operators and other officials are handled by a PGSI-10M loudspeaker system.

In the initial stage the network's software is based on local operational systems such as the OS 6.1 and the following programs: Remote problem input (UVZ); "Kontakt" remote station, and the "Kopiya" program, which supports intercomputer transmission of information banks from one magnetic tape to another. The UVZ

package is run in the central computer, the "Kontakt" program is run at a remote computer, and the "Kopiya" program is used for intercomputer exchange of information from one magnetic tape to another.

Using the UVZ, remote users can introduce problems into the input flow of the unified operating system of the central computer via communication channels, receive solved problems and transmit them to another remote user. The work of the UVZ is controlled by an operator at the central computer from a console or with an instruction-based systemic input unit making it possible to start or stop the UVZ, add or exclude a certain number of UVZ users, display the results of a problem submitted by a remote user to the central computer and provide information on the state of the UVZ system (lists of the problems being worked on, the remote computers being serviced and the information bulletins transmitted). Moreover the UVZ can be used to transmit a message to a remote user, to form and correct a set of information bulletins (this set is transmitted to a remote user when the latter connects himself to the UVZ, and it contains service information, for example on the time running of the UVZ starts and ends), and to obtain information on how well the communication equipment is functioning on all routes during each communication session. Information received by the UVZ from the communication channels may be transmitted in DKOI code ("transparent" mode) and in code KOI-7. The UVZ permits multiple and simultaneous access by remote users to the resources of the computer.

The "Kontakt" program provides for constant communication between the user of a remote computer and the central computer. It is used to transmit instructions from a remote computer to the central computer and reception of messages from the central operator by a remote operator; to transmit problems represented on punchcards or magnetic tape from a remote computer to the central computer; to print out problems solved by the central computer; to feed problems into the communication line and receive them from it; to transmit data banks stored on magnetic carriers from a remote computer to the central computer; to transmit sets of library data from the central computer to a remote computer; to use a particular unit as an intermediary to transfer information banks.

Instructions from a remote computer working with a UVZ program can be used to connect or disconnect a remote computer and remote user to the UVZ system; to obtain information on the state of a problem being solved in the central computer; to exclude a problem from the UVZ system; to obtain a read-out on particular problems or to resume read-out of problems at a remote computer interrupted for one reason or another; to obtain information bulletins from the central computer on the state of the system and to transmit a message to the operator of the central computer or another remote computer.

A package of problems transmitted from a remote computer to the central one via the UVZ system is assembled according to the usual rules adopted for an OS YeS. But for some modes of the UVZ system the first statement of the package must be preceded by a problem input definition statement (JED). This statement makes it possible to immediately transmit the results to the remote user (after the problem is solved by the central computer) or, on the operator's instructions, to a remote station (in this case the result of a problem may be transmitted to another remote computer); to inform the central and remote computers that the problem has been solved; to output the results of the entire problem or certain of its steps at the central computer.

Interchange of data banks between computers followed by duplication of these banks on magnetic tape by the computer receiving the data can also be achieved with the "Kopiya" program. This program must be running simultaneously in the two computers participating in the interchange. This program can be used to obtain a copy of the contents of a magnetic tape without restrictions on the volume of the data and its format.

The experience of working with the ETSVTs shows that information may be distorted both during data interchange and when control messages are transmitted. This is why analysis of failure situations in the "adapter-modem-communication channel-modem-adapter" channel and a possibility for multiple transmission of data in blocks and in files are foreseen in all programs.



11004
CSO: 1863/140

UDC 681.3.008

EXPERIENCE OF CREATING TIMESHARING MULTIPLE-USER SECTOR COMPUTER CENTER

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 1, Jan-Mar 82 (manuscript received 25 Aug 81) pp 60-61

[Article by Candidate of Technical Sciences E. P. Dmitriyev and Engineer L. G. Lapin]

[Text] Sector computer center networks, which bring together main and multiple-user computer centers as well as enterprise computer centers, are to play a significant role in improving the existing data processing systems and creating a state computer center network.

Multiple-user computer centers have a special place in sector computer center networks.

Practical experience with a computer center shows that creation of a multiple-user computer center may reduce the sector's demand for manpower to operate an automated control system by 40-50 percent and reduce, by 1.5-2 times, the demand for computers and the capital outlays on data processing. The calculated annual economic impact of this sector multiple-user computer center is about 6 million rubles.

One of the principal functions of a multiple-user computer center is to handle the data processing and computations associated with creating and operating automatic planning systems and production process control systems, and to support debugging and industrial operation of the automated control systems of user-enterprises. A software-hardware complex contained within the sector timesharing computer network has been created for these purposes.

The main principles upon which services to users rest include problem orientation, unity of data processing technology and specialization.

The problem orientation of computer complexes is a product of requirements associated with certain complexes of tasks. Thus creation of programs for equipment with ChPU [not further identified] and performance of design and engineering computations require creation of a two-computer complex with two or three punched tape output units connected to each computer. Moreover the computers must be furnished with graphical displays, automatic drafting systems, specialized complexes based on small computers etc.

A second complex based on YeS computers, display stations and small computers has been created as a means for planning automated control systems and servicing remote users. Its features include large working and auxiliary memories and presence of resources for remote debugging and for connecting the stations of remote users.

Industrial operation of automated control systems not requiring the participation of clients and developers has been achieved. This system is based on the principles of collective use of computer resources. Further developments of this system include use of a YeS-1060 and transition to industrial operation of a remote data processing system based on data transmission multiplexers and remote user stations.

Efforts have been made in all specialized complexes to increase the volume of the main memory to 512 kilobytes and one megabyte, and to furnish up to four-five magnetic disc auxiliary memories with a capacity of 29 megabytes and up to eight magnetic tape storage units. The principle of problem orientation was formulated during scientific research and experimental design work and during practical operation of the computers.

Unity of data processing technology is required due to the diversity of the data processing and computation jobs, use of all computers in three shifts and the high intensity of problem input (up to 20-30 units per day per computer). Operations associated with receiving, verifying, processing and outputing results to users are controlled by unified processing instructions intended for all types of jobs.

The principle of specialization reflects the unique features of each class of tasks (remote debugging, creation of programs for equipment with ChPU, design and engineering calculations etc.). These unique features are the product of certain additional processing operations required (coding and formalized description of raw data, automated graphical display with the purpose of verifying results and so on), which precede the standard processing routine or which are required for acquisition of a guaranteed positive result. For example cases of using programs with mistakes in them in metalworking processes must be excluded when preparing programs for equipment with ChPU. Specialized subdivisions have been created for operational communication with clients and for performance of additional processing operations required by each class of tasks.

The economic impact from centralizing data processing and computations (mass production of programs for equipment with ChPU, support of the operation of automated control systems on a computer timesharing basis, performance of design and engineering calculations, solution of problems for sector and territorial control organs etc.) was 1 million rubles in 1980.

In 1979 efforts were started in the multiple-user computer center to reequip the data preparation system. YeS-9002 magnetic tape data preparation units and two SPD-9000 outfits were introduced. As a consequence by as early as 1980 23 percent of all of the data preparation work was turned over to new equipment. In addition to preparation of data on magnetic tapes and punchcards, communication channels are used to transmit input data into the computer. In 1980, about 10 million symbols (5 percent of the total volume) were transmitted and received by the computer center via communication channels. Systems based on the ESTEL-2.1 (MPD-1), MPD-3 and MPD-1A were introduced for these purposes. YeS-7906 and YeS-7920-01 textual

display complexes were introduced for the purposes of remote debugging and providing information services to developers of automated control systems.

The basic program support includes the 2.1 DOS, 4.1 OS and 6.1 OS operating systems and the OKA, KAMA and DUVZ applications program packages. A library containing more than 11,000 programs intended for 1,200 automated control system functions and packages of programs to support and manage the data banks of automated control systems and automated design systems has been created at the multiple-user computer center. An information retrieval system based on the YeS-1033 has been created to service users of the algorithm and program library. Each year up to 60 enterprises use the services of the library.

The working experience of the computer center is now being applied in other areas of the country. This experience is being used as the basis to plan, monitor and analyze the introduction of computer technology.

The future directions for development of the multiple-user computer center include making a transition to a khozraschet basis for financing data processing and computation jobs, developing a data collection and processing system using state communication channels, user stations and broadening the range of clients and of the problems accepted for solution.

Transition to a khozrashet basis in the financing of data processing and computation jobs is necessitated by the fact that at the moment the multiple-user computer center cannot fulfill all orders from users. Were the existing system for financing the computer center to persist (it is now financed by allocations for scientific research and experimental design work), we would not be able to expand the range of its tasks or of the users to whom services are provided, since no plans have been made to increase the volume of work financed by allocations for scientific research and basic design work for the next 5 years. An investigation of the ways for solving this problem has shown that data processing and computation jobs may be financed by the user-enterprises, inasmuch as the user's outlays would be 1.5-2 times lower in this case than what they would have to pay if they did not use the services of the multiple-user computer center.

A data collection and processing system based on state telephone and telegraph communication channels and user-owned remote stations is being created in the multiple-user computer center. This will ensure both efficient services to users and lower outlays on data processing. Series-produced MPD-3 and MPD-1A multiplexers and the ESTEL-2.1 system are being used for these purposes. The user equipment includes T-63 teletype machines, the AP-1 and AP-2 (YeS-8501, YeS-8502), AP-4 (YeS-8504) and AP-70 (YeS-8570) user stations, and so on. Efforts are being made to incorporate a YeS computer into the computer system at the level of the auxiliary memories and communication channels.



11004
CSO: 1863/140

UDC 681.324

# ARCHITECTURE OF EXPERIMENTAL COMPUTER NETWORK OF LATVIAN SSR ACADEMY OF SCIENCES

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 1, Jan 82 (manuscript received 4 Oct 81) pp 80-84

[Article by E.A. Yakubaytis, Institute of Electronics and Computer Technology, Latvian SSR Academy of Sciences]

[Text] The problem of improving the efficiency of scientific research has become ever more urgent in recent years. This is associated with the fact that the work of institutes has become ever more dynamic and deadlines for relaying the results of research for use in the national economy have become ever shorter. The problem of exchanging information between teams working on the solution of common scientific problems has also become extremely important.

Computer technology has become the principal base for processing information obtained as the result of scientific experimentation or theoretical research. However, the forms of its utilization all the same do not satisfy investigators. In the ordinary teleprocessing system a scientific associate can interact through a telephone system or through a special channel with one or, in the best instance, two computers. The remaining computers are inaccessible to him. Meanwhile, in just a single science center of average size the number of computers measures in the dozens. Generally, interacting with computers located at other science centers by means of a teleprocessing system is not to be heard of.

A solution to the problem of interacting with a great number of computers is represented by the architecture of the multicomputer association called a computer network. Similar structures have already been created in the Soviet Union [1-3], the USA [4], France [5] and other countries. The architecture of the distributed computer network of a science center is discussed in this article. The implementation of this architecture is demonstrated in the example of the Latvian SSR Academy of Sciences Experimental Computer Network (EVS).

The basic element of the model discussed is the system--one or more computers with their peripheral equipment, adapters, terminals and software. The functional characteristics of systems together with their lines of interaction, called physical connections, form the logical structure of a computer network. Each of the systems created is open-ended, for it satisfies the general requirements [6] of the architecture for the interaction of open-ended systems of the International Organization for Standardization (MOS [ISO]).

All systems are divided into a number of strata, called levels. Each level performs a specific functional task in the computer network and provides service for the level above it. The compendium of rules for the interaction of entities of like (identical) levels of different systems is called the protocol.

In the ISO model of a computer network discussed there are seven functional (logical) levels. The tasks performed by these levels are described in table 1.

Table 1. Functions Performed by Levels of Systems

| No of level | Name of level | Functions implemented by level |
|---|---|---|
| 7 | Applied | Offering or use of information resources: control of applied programs of users, terminals and operator stations; administrative management of network |
| 6 | Representation | Representation (interpretation) of the meaning (value) of information transferred by applied programs, including conversion of instructions and data |
| 5 | Run | Organization and performance of runs of interaction between applied programs |
| 4 | Transport | Transfer of arrays of data coded in any manner |
| 3 | Network | Routing and addressing of information; control of data array streams |
| 2 | Channel | Establishing, maintaining and breaking a connection |
| 1 | Physical | Physical, mechanical and functional characteristics of a connection |

The solution of diverse network problems is made possible by the specialization of systems, illustrated in table 2.

Table 2. Computer Network Systems

| No | Name of system | Tasks performed by system |
|---|---|---|
| 1 | Operating | Offering resources of the network: storage of data files; retrieval of information; performance of computing tasks; simulation of processes, phenomena and entities; and development of software |
| 2 | Terminal | Use of network's resources: control of operation of terminals, preparation of assignments, interfacing with technological processes for the purpose of measuring and controlling them |

[Continued on following page]

| | | |
|---|---|---|
| 3 | Administrative | Administrative management of computer network (gathering of statistics, keeping records of work, issuing reports, diagnosis of malfunctions, information regarding the network's operation, etc.) |
| 4 | Communication | Routing and control of streams of information to be transferred between operating, terminal and administrative systems |

Operating, terminal and administrative systems are called user's systems. All systems have a 7-level logical structure. However, in administrative and communication systems levels 4 to 7 are used only for administrative management. In other systems these levels provide both basic (relating to the interaction of user's programs) and administrative control.

The structure of a user's system is illustrated in fig 1 and the structure of a communication system in fig 2. The two top levels of each system determine information processes (representation of data, control of applied tasks, administrative management). The five lower levels form the network method of access to these processes.

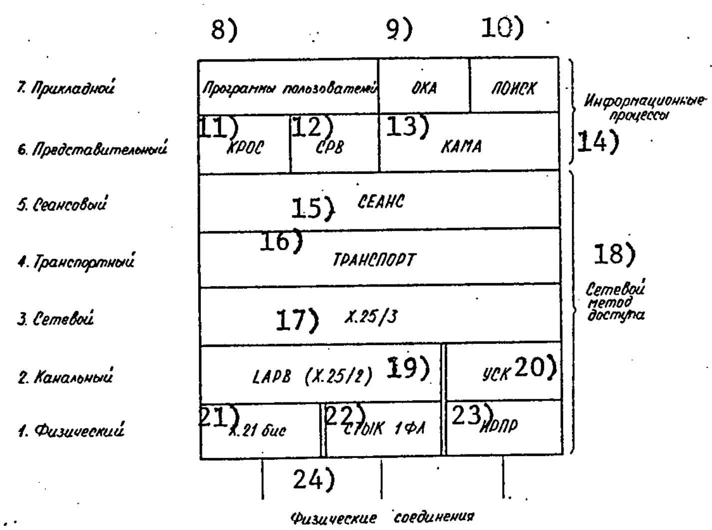


Figure 1. Structure of User's System

Key:

| | | | |
|---|---|---|---|
| 1. Physical | 9. OKA | 15. RUN | 22. STYK 1FL [interface] |
| 2. Channel | 10. POISK | 16. TRANSPORT | 23. IRPR |
| 3. Network | 11. KROS | 17. X.25/3 | 24. Physical connections |
| 4. Transport | 12. SRV | 18. Network method of access | |
| 5. Run | 13. KAMA | 19. LAPB (X.25/2) | |
| 6. Representation | 14. Information processes | 20. USK | |
| 7. Applied | | 21. X.21 bis | |
| 8. User's programs | | | |

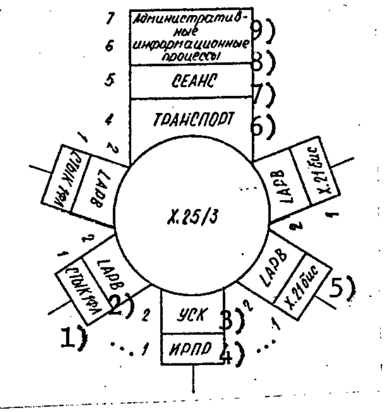


Figure 2. Structure of Communication System

Key:

1. LAPB
2. STYK 1FL
3. USK
4. IRPR
5. X.21 bis
6. TRANSPORT
7. RUN
8. Information processes
9. Administrative

Connections of three types are used at the physical level of these systems. The first is defined [7] by Recommendation X.21 bis of the Consultative Committee on International Telegraphy and Telephony (MKKTT [CCITT]). This connection is designed for operating through standard modems and analog telephone communications channels. STYK 1FL is [8] the Soviet standard governing the serial transmission of data through 2- or 4-wire physical lines. The IRPR (parallel radial interface) standard is used in the International System of Small Computers of socialist countries. Here the parallel transfer of data through nine lines (byte + parity check bit) is accomplished.

Two kinds of protocols are used at the channel level. The first, LAP/B, is defined [7] by CCITT International Recommendation X.25. The second was developed [8] by the Institute of Electronics and Computer Technology of the Latvian SSR Academy of Sciences. A protocol corresponding to CCITT International Recommendation X.25 [7] is used at the network level.

At the transport level the TRANSPORT protocol is used, conforming to the standard [9] of the European Computer Manufacturers' Association. The protocol of the run level was created at the Institute of Electronics and Computer Technology.

The upper levels of the protocols of user's systems (the sixth and seventh) are governed by the standards for YeS [Unified Series] computers. They are the KROS (planned computing operations), SRV (interactive preparation of programs), KAMA

and OKA or POISK (data banks with information services) programs. Programs written by users for scientific trends being investigated by them work with these system programs.

The upper levels of the protocols of communication systems are designed for the performance of administrative information processes associated with the gathering of statistics on streams of data and the issuing of information and reports on the operation of the communication system.

These systems are implemented by the programs of the user's and communication systems. For the physical linking of systems with one another their structure includes adapters which perform functions determined by protocols of the first and second levels.

The Communication Service Operating System (OS KS) performs communication tasks for packets in SM-4 minicomputers. The present version of the OS KS controls processes with three levels of priority. The main ones are as follows:

1. The process of initializing the system
2. Servicing standard peripheral units (disk, alphanumeric printers, operator's displays)
3. Issuing reports on the operation of the system
4. Servicing operator's requests
5. Controlling adapters
6. Implementation of protocols of the second level (USK and LAP/B) in each physical channel
7. Implementation of the X.25/3 protocol
8. Gathering statistics on operation of the system
9. Routing of packets

Each system listed in table 2 is implemented in one or more computers (large, medium, small or micro) and each physical connection is accomplished by means of a channel. As a result, the logical structure is converted into the physical structure of a computer network illustrated in fig 3.

As can be concluded from this figure, the experimental computer network (EVS) of the Latvian SSR Academy of Sciences is a multicomputer hierarchical computer association uniting into a single complex special-purpose machines, in terms of structure and software, offering hardware and software for collective use by the academy's scientific associates.

The creation of the EVS has been pursuing two major goals:

1. Carrying out scientific research in the area of the architecture of computer networks
2. Constructing a base for the academywide system for automating scientific research

The operating systems determine the main computing and data processing resources of the EVS. Each operating system includes a YeS-1045 or YeS-1033 computer and a

network microprocessor adapter (A). The system is controlled by the OS 6.1 standard operating system, to which the network method of access has been added. This makes it possible for a YeS computer to interact with the network.

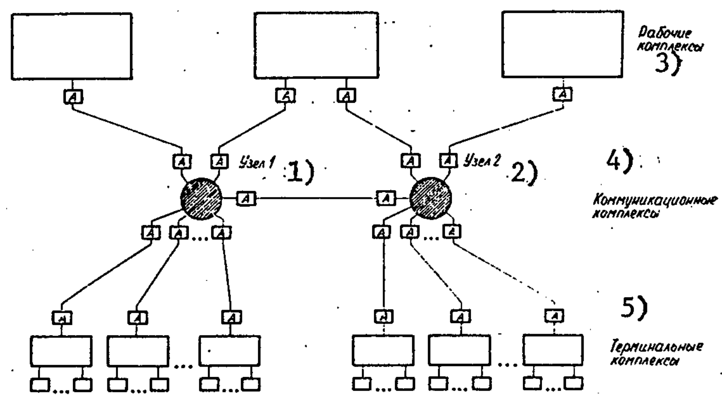

Figure 3. Physical Structure of Experimental Computer Network (EVS)

Key:

1. Unit 1
2. Unit 2
3. Operating complexes
4. Communication complexes
5. Terminal complexes

Each communication system is a multiprocessor system. The first two levels of protocols are performed here by microprocessor network adapters. The upper levels are implemented by means of SM-4 computers.

Terminal systems are constructed on the basis of SM-3, SM-4, ISKRA-126 and Wang-2200 minicomputers. Each of these systems makes possible the interactive preparation of assignments, the management of a library of texts and interaction with YeS-computer system programs.

The exchange of information between operating and terminal systems is accomplished by means of "Data" packets defined by Recommendation X.25 approved by CCITT. Virtual (logical) channels are set aside in the EVS for this purpose.

The EVS is a continuously developing computer network expanding to an ever greater extent services offered to users. The following services are offered in the computer network at the present time:

Creation of libraries of texts in terminal systems; editing of texts in the dialogue mode; dialogue preparation of assignments in YeS-computer languages (PL-1, FORTRAN, ASSEMBLER, etc.); control of local banks of tasks and banks of solutions arrived at; storage of any texts in a file storage; planning of computing work; remote input of assignments and output of solutions; offering operating systems to be selected

by users; address-less execution of tasks; storage of "general delivery" solutions; automatic recoding and reformating of information when transferring it from one complex to another; automatic copying of information from one medium to another (e.g., punched cards of a YeS computer onto the magnetic disk of a minicomputer); output of information on the passing of assignments and solutions through the computer network; exchange of information (electronic mail) between operators; output of information to peripheral units of computers implementing operating or terminal systems (displays, printers, punched card output, etc.).

The computer network which has been created represents the information base of the Latvian SSR Academy of Sciences scientific research automation systems. Its use makes possible efficient dynamic data processing and makes it possible to shorten considerably the time for performing jobs.

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8831
CSO: 1863/119

UDC 681.324

# METHODS OF ENSURING RELIABLE FUNCTIONING OF COMPUTER NETWORKS

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 1, Jan 82 (manuscript received 8 Jul 81) pp 85-95

[Article by A. Yu. Gobzemis, O. S. Denisenko and E. N. Tsvetkova, Institute of Electronics and Computer Technology, LaSSR Academy of Sciences]

[Excerpt] Conclusion

The review of published studies presented demonstrates that in spite of the urgency and great practical significance of research in the area of the reliability and diagnosis of computer networks, this scientific trend can not be considered even to have been formed. Of special interest for scientific developments is a study of the dynamic approach to analyzing the functioning of a computer network. The fact is that the mathematical models used at the present time are not always adequate for the entity being simulated, since they are oriented toward studying the structural properties of computer networks and not processes of the processing of data in them.

Studies have shown that at any level of the discussion of computer networks and systems we encounter the concept of a defect (error, failure), as a condition of the deviation of some parameters from prescribed limits. It is necessary to design appropriate tests for the purpose of detecting and localizing these defects. However, the concepts of a defect and test can differ substantially depending on the specifics of the entity studied and the degree to which it is detailed. Further development of a hierarchy of diagnostic models corresponding to the hierarchy of problems in analyzing computer networks is necessary.

Many methods of evaluating reliability and recommendations on preventive maintenance for complex systems are based on the statistics of failures possible in them. Obtaining these statistics for computer networks is an important goal of future research.

One of the most important features of computer networks is their use for teleprocessing. This results in the necessity of the exchange of large arrays of information between computers, which, as a rule, involves a considerable number of errors. Methods of detecting and correcting errors which have been developed in communications theory do not always take into account features of the logical structure of a computer network and the possibilities of utilizing its natural redundancy for the purpose of improving functional reliability.



8831
CSO: 1863/119

COMPUTER NETWORK DEVELOPMENT AT USSR OFFICE OF STATISTICS

Moscow VESTNIK STATISTIKI in Russian No 1, Jan 82 pp 8-15

[Article by Stanislav Nikolayevich Bushev, candidate of technical sciences, docent, chief of GUVR TsSU SSR (Main Administration of Computer Operations, USSR Central Office of Statistics): "Tasks of the Computational Network of USSR TsSU in the 11th Five-Year Plan"]

[Excerpt] At present within the USSR TsSU [Central Office of Statistics] system there operate about 3,000 computer (information-computer) centers and information-computer and machine-processing stations which, in addition to their principal function of collecting and processing information for state statistical agencies, process economic statistics from enterprises and organizations as well as from kolkhozes, sovkhozes, and other agricultural enterprises. During the 10th Five-Year Plan alone more than 200 computer centers have been set up within the USSR TsSU system. The proportion of computer centers in the overall number of organizations of the computational system has increased from 10 to 18%. The overall computer pool of the computational network of the USSR TsSU has increased by a factor of 2.2 since 1975.

What then are the main directions of development of the computational network of the USSR TsSU in the 11th Five-Year Plan?

Increase in the effectiveness of ASGS [Automated system for state statistics]. The activation of the second stage of the ASGS has served to greatly improve the quality of statistical information in proportion to the growing needs of the planning and management of the economy. Thus while employment in the computational network of the USSR TsSU has increased by 20%, the volume of operations performed has increased by a factor of more than 1.6.

The improvements in information processing techniques and the effective utilization of the technical facilities of the second ASGS stage contributed to shortening the periods of processing statistical information at the Union level by 1-5 days for urgent reports, 3-10 days for quarterly reports, and 10-65 days for yearly reports.

Plans exist to further expand the work to refine ASGS and the methods of computing and analyzing statistical information. Here, special attention should be paid to reducing the information-processing periods, analyzing of the patterns and trends of processes and phenomena, and increasing the effectiveness of social production. In this connection, the work to develop functional ASGS subsystems should be continued, upon focusing attention on such inter-sector functional subsystems as "Balance Sheet of the National Economy" and "Statistics of Labor and Wages."

To further refine the comprehensive analysis and solve the problems of preparing statistical forecasts, the work to set up automated data banks at various computer centers of the main statistical offices of the Union republics will be as well as at VTsKP [Collective-use computer centers] continued. Since 1975 the USSR TsSU has been working to introduce all-Union classifiers of technical and economic information. Such classifiers already have been introduced and are widely employed in the work of state statistical agencies with respect to factors such as: branches of the national economy, agencies of state administration, enterprises and organizations, etc. So far 24 all-Union classifiers have been developed, of which 13 are used in practical work. Since 1981 OK TEI [All Union classifier of technical and economic information] codes have been used at enterprises, in Union, republic, and local organizations and institutions, and at the USSR and Union-republic ministries and departments. The TsSU of the USSR has drafted measures providing for the introduction of new OK TEI codes in enterprise statistical report forms beginning with the 1981 annual report.

In the course of the formation and development of ASGS functional subsystems the problems of their interfacing with the corresponding subsystems of such automated systems as ASPS [Automated system for planning calculations], ASFR [Automated system for management of financial calculations], and others, should be resolved. Here, attention should chiefly be focused on the solution of problems of the informational, technical, and program compatibility of the automated systems, we as well as on providing a range of information fully meeting the needs of users. Software systems for the ASGS, which are developed by the VGPTI [All-Union State Design-Technological Institute for Mechanization of Accounting and Computers] of the USSR TsSU, should be further refined.

To improve concrete program facilities, plans exist to convert all the EOI [electronic data processing] complexes operating on the basis of the Minsk-32 computer to the new technical basis (YeS EVM [Unified System of Electronic Computers)] in an operating-system environment. The improvements in old and development of new EOI complexes will be carried out with the aid of systems software, ABD [automated data banks], and STOSI [system for remote processing of statistical data]. In addition, the development and introduction of techniques for processing low-volume statistical tasks on the basis of mini- and micro-computers should be regarded as an important task.

Computer-based processing of statistical information should be maximally geared toward use by statisticians by presenting means of operative access to the information resources of the ASGS in order to obtain the needed data.

In the creation and development of functional subsystems special attention should be devoted to reducing the time of statistical work by improving the organization of processing and using new up-to-date computers and a remote data processing system.

To promote the fulfillment of the tasks to improve the performance of agencies of the USSR TsSU during the 11th Five-Year Plan, it is necessary to further develop technical facilities as the material basis for raising the level of the automation of all stages of the technological process of the collection, preparation, monitoring, and processing, and publication of statistical information and providing provision of computational services to enterprises and organizations of the economy. This entails plans for a marked expansion of the facilities at the republic and oblast computer-center levels of the YeS EVM, including expansion of their peripheral hardware, as well as broadening of the work to convert to the non-keypunch metch method of data setup which should make it possible not only to improve quality of performance but to reduce the demand for paper tape carriers.

Considerable attention should be devoted to the rayon-level element of the USSR TsSU computational network. Along with introducing the M 5000 type PVK [Punchcard computer complex] it will be necessary to carry out the trial introduction of microcomputers. In this connection, continuity between the existing and newly introduced means of computer technology should be assured. The experimental development of rayon-level distributed computer system also is being planned.

The computational network of the USSR TsSU in the 11th Five-Year Plan will be mainly equipped with the YeS-1022 and YeS-1035 computers. This will contribute to consolidating the technical basis of the computational network of the main statistical administrations of the Union republics, which at present are equipped only with third-generation computers, complementing the facilities of the oblast-level computer centers conducting systems-type processing of statistical information with the aid of the Minsk-22 computers and lacking YeS EVM, as well as developing the technical facilities of oblast-level computer centers, at which ABD and STOSI will be introduced. YeS-1045 and YeS-1060 type computer models with high-speed processors will be used as the technical basis of new VTsKP [Collective-use computer centers], while YeS-1055 computers will be added to the computer pool of the USSR TsSU Main Computer Center.

During the 10th Five-Year Plan the USSR TsSU system has been provided with M 5000 (M 5010, M 5100) type punchcard computer complexes, which makes it possible to dispense with the use of a large number of tabulators and "Tsellatron" ERA at rayon-level statistical offices. During the 11th Five-Year Plan preparations will also be carried out to incorporate small computers and microcomputers in the USSR TsSU system.

To reduce the consumption of punch cards and improve the information processing technology, the conversion of the setup of computer data to magnetic tape carriers is under way.

At the rayon level of the USSR TsSU computational network more than 1,000 punchcard computers and tens of thousands of keyboard computers are operated. During the 11th Five-Year Plan about 30% of bookkeeping machinery will be replaced with its more up-to-date counterparts.

Plans also exist to continue the work to introduce centralized maintenance of the USSR TsSU system.

Establishment and development of collective-use computer centers: this is regarded as a major scientific and technical problem. The targeted comprehensive scientific and technical program for 1981-1985 provides for setting up, within the USSR TsSU system, the first stage of such VTsKP [Collective-use computer centers] in the cities of Kiev, Alma-Ata, Vilnius, Frunze, Voronezh, Saratov, Vinnitsa, and L'vov, and subsequently also in Minsk, Tallinn, Tomsk, and Tula.

A special feature of the establishment of VTsKP during the 11th Five-Year Plan is the marked increase in the volume of design-technology work and the tighter requirements as to its performance. Compared with the 10th Five-Year Plan, during the 11th the volume of the work to establish and develop VTsKP will have been more than tripled. The draft of the working plan provides for: development of research into the problem of establishing VTsKP; development of technical working projects of newly established VTsKP; development and introduction of software and information programs; development of material-technical facilities of VTsKP and their subscriber networks; development and introduction of projects for processing subscriber information; personnel training; and the on-schedule opening of VTsKP. This involves the task of increasing the effectiveness of R&D work, reducing the periods of its application, and assuring a rational utilization of financial, material, and manpower resources.

The new VTsKP being established in the 11th Five-Year Plan will chiefly differ from their existing counterparts in being better-equipped. They will be equipped with YeS-1045 computers (the VTsKP in Minsk, Tallinn, Tula, and Tomsk had been established on the basis of YeS-1033 computers). Plans exist to supply system-wide software that has been refined and adapted to the conditions of VTsKP--OKA, KAMA, ROS, SPO-397, and other program libraries. The work to select subscribers and set up their tasks will be of a more purposive nature in order to maximize the effect of computational operations and the utilization of computer resources.

The principal direction of the work to establish the second-stage VTsKP will be to develop their subscriber networks on the basis of the use of mini- and micro-computers. In connection with the increase in the number of newly established VTsKP and in the volume of operations during the 11th Five-Year Plan, the role and responsibility of the main administrations for computational work at the Union republic main statistical administrations as regards the establishment of VTsKP will also increase.

In accordance with the working plan the development of technical tasks for the establishment of VTsKP will soon be completed, as will be the development

of segments of the working project, "The Equipping of VTsKP and Subscriber Terminals," and "The VTsKP Subscriber Network and Data Transmission Channels." The end-goal of the working plan is to establish major computer centers within the USSR TsSU system, to broadly introduce advanced data-processing technology and on this basis to increase labor productivity, to reduce the cost of computerized data-processing operations, and to markedly increase the efficiency of utilization of means of computational technology.

The establishment of second-stage VTsKP will result in the further development of VTsKP subscriber networks. Up to 40 subscribers should be linked to every the subscriber network of every VTsKP.

The establishment of VTsKP will contribute to the accomplishment of the tasks posed by the 26th CPSU Congress to the state statistical agencies. It should be stressed that the VTsKP of the USSR TsSU system take a direct part in fulfilling the highly complex operations to set up the third stage of the ASGS. "ABD ASGS" automated ASGS data banks will be organized at every VTsKP. At some VTsKP, chiefly those at the republic level, plans exist to introduce the STOSI [System for remote processing of statistical information] currently being developed within the USSR TsSU system. The developed VTsKP facilities will serve to consistently elevate the level of integration and quality of processing of statistical data.

The program for establishing VTsKP is complex and extremely compressed, so that its fulfillment even now requires mobilizing the efforts of all organizations of the USSR TsSU and statistical administrations of the Union republics, as well as of the NII [Scientific Research Institute] and VGPTI of the USSR TsSU, and the computer centers.

Expansion and improvements of the work to introduce comprehensive mechanization of accounting operations at enterprises and organizations of the economy. Currently the USSR TsSU computational network serves more than 92,000 customers, including about 33,000 kolkhozes, sovkhozes, and other agricultural enterprises; 11,500 centralized accounting offices of budget institutions and enterprises and organizations operating on the basis of cost-effective accounting, as well as 11,100 state-trade and consumer-cooperative enterprises. The share of computer-based operations performed in behalf of social welfare agencies, the Stroybank, and state insurance agencies has grown. Comprehensive mechanization of accounting operations has been introduced at 2,551 agricultural enterprises, 364 centralized accounting offices of budget institutions, and 361 consumer-cooperative enterprises. In 1980 the Latvian SSR became the first republic at which the comprehensive mechanization of accounting operations was introduced in all kolkhozes and sovkhozes. In addition, such mechanization has been introduced in all kolkhozes and sovkhozes in 13 rayons of other republics (5 in the RSFSR, 2 in the Ukrainian SSR, 2 each in the Ukrainian, Belorussian, and Kirghiz SSRs, and 1 each in the Lithuanian and Kazakh SSRs).

A basic task of the current five-year period in this respect is to draw the attention of enterprises and organizations of the economy to the services of the computer centers and stations of the USSR TsSU system and to convert

the processing of customer-provided information from punchcard and keyboard machines to computers, as well as to broaden the scope of the operations performed and especially to introduce the comprehensive mechanization of accounting operations.

During the 1981-1985 period the comprehensive mechanization of accounting operations should be introduced at 1,600 kolkhozes and sovkhozes, 1,600 enterprises and consumer-cooperative organizations, and 876 centralized accounting offices of budget institutions with which bilateral plans have been agreed upon and approved.

During 1981-1985 the services of the USSR TsSU computational network should be additionally extended to some 500 social welfare organizations. In addition computers should be used to process data at 435 state insurance inspectorates and, by 1985, the volume of computer services provided to the Stroybank should be increased 28%.

To accomplish the tasks posed, it is necessary to: complete the development of standard designs for comprehensive mechanization of the accounting operations of customers on the basis of YeS EVM; improve the existing standard designs for the mechanization of accounting on the basis of M 5000 (M 5010, M 5100) PVK; develop standard designs of new computer types; elevate the level of organizational work at the main administrations of computational work (RVTs [Distributed computer centers]) of the Union-republic statistical administrations; tighten the requirements for the computer centers and stations which underfulfill the plans for introducing comprehensive mechanization of accounting operations; utilize all existing potential to fulfill the aforementioned plans for the current five-year plan period; and carry out experimental work on the automated computer-based set-up of customer statistical reports on the basis of the processing of accounting data.

Improvements in the administration, planning, and administrative machinery of the USSR TsSU computational network. Beginning with 1981 the GUVR TsSU of the USSR converted to preparing comprehensive plans of operations of the computational networks of Union-republic main statistical administration. This orientation should be pursued even though it entails difficulties, especially as regards the balancing of plans.

In 1980 the periods of transmittal of the basic indicators of the industrial and financial plans to the republic main statistical administrations were markedly shortened, which enabled a majority of the GUVR (RVTs) offices to transmit plans to computer centers and stations 45 days prior to the commencement of the 1981 plan year, as envisaged in the Decree of 12 July 1979 of the CPSU Central Committee and the USSR Council of Ministers. In other words, the computational network of the USSR TsSU has started to implement the tasks posed by the 26th CPSU Congress.

The Basic Directions [of Economic and Social Development of the USSR] specify a task directly touching upon the work of the computational network of the USSR TsSU: "Strengthen the importance of the five-year plan, which is the

chief tool for implementing the party's economic policy....make a fuller allowance for.....internal production potential...." Our task, like that of industry and construction, is to convert computer centers and stations to work on the basis of five-year plans, and to promote the initiative of their employees in adopting counter-plans. The five-year and annual plans of the computer centers and stations should be developed on the basis of economic and technical calculations, and the plan targets should not be based alone on the previous growth rate of the corresponding indicators.

Long-range plans for the development of the USSR TsSU computational network should primarily allow for the tasks ensuing to the state statistical agencies, on proceeding from the long-term socio-economic tasks outlined by the party, as well as from the comprehensive program for scientific and technical progress.

The Basic Directions of Economic and Social Development of the USSR Specify: "Achieve an increase in profitability, [and] elimination of production losses...." To accomplish this, we have to do a tremendous amount of work. The problem of eliminating operating losses at MSS [machine accounting stations] and RIVS [rayon data processing station] should be finally resolved. The center of gravity in this work should be transferred to the GUVR (RVTs) offices of the Union republics, which should thoroughly examine the performance of every station that has been operating at a loss for many years.

It is an intolerable situation when some stations handle the increased volume of their operations solely by augmenting the mean daily work-load of their computers to the capacity limit instead of by resorting to new equipment and hiring more personnel.

Another topical problem is that of converting computer centers to the new system of planning and economic incentives.

In the 10th Five-Year Plan period special attention was devoted to broadening the introduction of the progressive form of settlement of accounts with customers at computer centers and MSS on the basis of plan-stipulated payments.

The introduction of plan-stipulated payments sharply reduced the interval of time between the completion of an assignment and the receipt of and crediting of payments for the completed assignment.

The conversion to this form of settlement of accounts with customers not only contributes to reducing the indebtedness of customers and shortens the turnover time of liquid capital but also, and most importantly, contributes to fulfilling the plan of sales in our system with respect to receipts and crediting of funds, by contrast with the current procedure for determining the fulfillment of the volume of operations as a function of the presentation of bills for payment. In other words, the system of planned payments is a step on the road toward the introduction of the new system of planning and economic incentives, in which one of the major conditions is the fulfillment of the plans of sales with respect to receipts and crediting of funds.

The indicator of the available quota-exceeding inventory of products and commodities adversely affects the financial condition of the organizations of the USSR TsSU computational system and sharply reduces their payment capability.

These shortcomings influence the directions of financial measures for the current five-year period: improvements in financial planning given the extension of the Charter of the Socialist State Production Enterprise to the computer centers; further increasing of the autonomy of computer centers and machine accounting stations with respect to their financial and economic activities; introduction of the settlement of accounts with customers on the basis of planned payments at all computer centers and machine accounting stations; improvements in organization and tightening of requirements as regards the balancing of receipts and expenditures at all levels of the USSR TsSU computational network; and strengthening of the supervision of the observance and implementation of the regulations and directives of the USSR TsSU by local agencies.



1386
CSO: 1863/132

PROBLEMS OF PLANNING AND DEVELOPMENT OF COMPUTER CENTERS AND COLLECTIVE-USE SYSTEMS (ALL-UNION SCIENTIFIC AND TECHNICAL CONFERENCE)

Moscow VESTNIK STATISTIKI in Russian No 2, Feb 82 pp 71-75

[Article by T. G., Moscow]

[Excerpt] The Fourth All-Union Scientific and Technical Conference "Problems of Planning and Development of Computer Centers and Collective-Use Systems" was held in Minsk in October 1981 by the USSR State Committee for Science and Technology, USSR Central Statistical Administration, BSSR Central Statistical Administration, All-Union Scientific Research Institute of Problems of Organization of Management, Belorussian Branch of VGPTI [All-Union State Design-Technological Institute for Mechanization of Accounting and Computers], Central Statistical Administration, USSR, and republic VTsKP [collective-use computer center], Central Statistical Administration, BSSR.

The purpose of the conference was to discuss the program for creation of a state network of computer centers (GSVTs) during the 11th Five-Year Plan, creation of collective-use computer centers based on the VTs [computer center] of organizations of state statistics, to exchange experience of planning, introduction and operation of VTsKP and computer systems during the 10th Five-Year Plan and to solve economic and organizational and legal problems of the functioning of VTsKP, the use of domestic hardware, analysis and selection of information and programs systems and information processing technology at VTsKP and collective-use computer systems (VSKP).

The timeliness of holding the conference follows from practical problems in development of GSVTs during the 11th Five-Year Plan, formulated in the "Basic directions of economic and social development of the USSR for 1981-1985 and for the period up to 1990" and of problem-oriented directions of scientific research and planning-design work that ensure fulfillment of the decisions of the 26th CPSU Congress on problems of increasing the efficiency and quality of utilization of computer equipment based on the complex systems approach.

The conference became a representative forum in which, along with specialists of scientific research institutions, representatives of organizations that directly produce and operate computer equipment participated actively.

More than 500 persons from many leading scientific centers of the country participated in the work of the conference. Representatives of more than 200

organizations from 46 cities gave talks or discussed problems of developing computer centers and collective-use systems.

The conference was opened by the deputy chief of the Central Statistical Administration, BSSR, M. Dichkovskiy, who noted that development of a collective-use computer center is one of the most effective directions in work on the use of modern computer equipment for further improving the methods and means of organizing management of the national economy, one of the most realistic methods of extensive use of computer equipment and communications for automation of gathering and processing of information used for accounting, planning and management of the national economy. The Central Statistical Administration, BSSR, its Main Administration of Computer Operations, the RVTs [regional computer center] and the BF [Belorussian branch], VGPTI, Central Statistical Administration, USSR, successfully implemented scientific development, planning and creation of the republic's first territorial VTsKP in Minsk, accepted for industrial operation at the end of 1980 and converted to a republic collective-use computer center of the Central Statistical Administration, BSSR.

The second unit of the republic VTsKP, Central Statistical Administration, BSSR, and the first unit of the VTsKP at Brest must be turned over for operation during the 11th Five-Year Plan and interaction of these VTsKP and also the collective-use computer center and the computer centers of oblasts, ministries and agencies of the republic must be organized.

The deputy chief of the Main Administration of Computer Operations and Control Systems of GKNT [State Committee for Science and Technology] B. Senyaninov gave a report "Program for Creation of a State Network of Computer Centers (GSVTs) during the 11th Five-Year Plan." It was noted that work to create a VTsKP during the 10th Five-Year Plan was the beginning for development of the state network of computer centers since the complex approach for solving problems appeared. Speaking about creation of a GSVTs in the future, the reporter emphasized that many unresolved problems arise during functioning of a VTsKP: economic-legal, financial questions and so on. A complex systems approach that ties a large number of co-executors into a unified creatively arranged collective is required in such large-scale and multiplanning work. Moreover, a no less important problem is standardization of information services and programs and unification and standardization of basic planning decisions. Fulfillment of all these requirements makes it possible to reduce considerably the time for development of a GSVTs, to achieve an important saving and thus to accelerate solution of the problem as a whole. The main material base of the GSVTs will be collective-use computer centers, the sphere of influence of which it is planned to include individual regions and sectors of industry and large territorial-industrial complexes. The reporter emphasized that hundreds of scientific research and production collectives united by a special specific complex scientific and technical program confirmed by GKNT, USSR Gosplan and the Presidium of the USSR Academy of Sciences, are participating in solution of problems of creating a GSVTs. It is planned to introduce 22 new territorial VTsKP prior to 1985 within this program. The main product of the GSVTs is information, on the basis of which recommendations and proposals for making management and production decisions are worked out. The main product in the economic mechanism of the VTsKP should be to consider the development of programs and to make it available as user services.

Problems of mathematical modelling to evaluate the results and to develop forecasts occupy an important position in creation of such complex systems as GSVTs. However, the proper attention is still not being devoted to this problem at scientific research institutions who are developing the systems. Foreign experience shows that introduction of simulation modelling yields an important production-economic effect. As is known, modelling is a more complicated process that requires high professional mathematical training.

Being guided by the decisions of the party and government on development of Siberia and the Far East, basic attention must be concentrated on equipping these regions of the country with GSVTs.

All these measures are directed toward fulfilling the decisions of the 26th Party Congress to increase the efficiency and quality of management of the national economy using means of automation.

The experience of the past five-year plan showed the correctness of the selected direction to create experimental collective-use computer centers as the basic element of a GSVTs. A total of seven VTsKP, the positive experience of which in working out the ideology and practice of VTsKP permits one to state that the selected direction of creating GSVTs is correct and reflects the socialist principles of management of the national economy, were created and have been functioning successfully during these years. The collectives of VTsKP of Minsk, Tula and Tomsk achieved the greatest success in creation and introduction of new progressive forms of using computer equipment for collective services. The collectives of these organizations are coping successfully both with production problems and with solution of scientific and technical problems of an applied nature.

The chief of department of GUVR [expansion unknown], Central Statistical Administration, USSR A. Shchukin outlined the problem of developing a VTsKP on the basis of the computer centers of the USSR Central Statistical Administration.

The reporter emphasized the enormous significance of the computer system of the USSR Central Statistical Administration in implementing the program for developing a VTsKP in the country.

The computer network of the USSR Central Statistical Administration has now been formed into an entire sector that has highly qualified personnel and a modern engineering base at its disposal. This is one of the most branched and powerful computer systems in the country, designed on the territorial principle and numbering 2,868 computer centers and information-computer stations, of which 176 function at the union, republic and oblast levels. The computer centers have accumulated extensive positive experience in processing statistical, economic and other information for accounting, planning and management. The computer centers of the USSR Central Statistical Administration now process information for more than 90,000 enterprises and organizations of different ministries and agencies. They made an important contribution to development and assimilation of computer equipment and software of different designation in the country. Therefore, the organizations of the USSR Central Statistical Administration have coped most successfully with the task of

developing VTsKP. During the 10th Five-Year Plan VTsKP were created for the first time and solution of a number of complex problems, primarily problems of scientific and methodological support of planning to determine the conditions under which collective-use systems can be created on the basis of the hardware and software of the YeS EVM, to determine the contingent of users (users of VTsKP) and also the composition of the detail plan and the volume of planning work, to develop the strategy and tactics of planning, to determine collectives of workers and to organize their interaction that ensures the continuity of the phases and units of planning and VTsKP had to be found during organization of work.

The program for developing a VTsKP is complex and considerable efforts of scientific, planning and production collectives must be recruited to implement it. However, a large volume of the most complicated work has been carried out by the collectives of computer centers, on the basis of which VTsKP were created in Minsk, Tallin, Tomsk and Tula. It is these collectives that have made the greatest contribution to working out the configuration of the collective-use computer system, development of data teleprocessing networks and the configuration of software. They provided the development and introduction of the technique of remote information processing and data banks under industrial conditions.

The VTsKP in Minsk, Tallin, Tomsk and Tula function on cost-accounting principles. They provided fulfillment of production tasks of the first year of the five-year plan and occupy the winning positions with respect to the results of socialist competition. The experience of operating them confirms the effectiveness of concentrating information processing at large computer centers.

Investigations to create VTsKP on the basis of the computer centers of the USSR Central Statistical Administration will achieve further development during the 11th Five-Year Plan. All the existing software of the VTsKP has been analyzed for standardization and transfer of it to the newly created centers. Investigations were begun in 1981 to create unified data teleprocessing equipment on the basis of the KAMA PPP [applied program pack], that permit maintenance of a wide range of user stations of different types working in parallel and typical data bases. Investigations were begun on formation of typical program packs for solving problems of the users of VTsKP, in which the problems of different users selected according to specific criteria were formed on a unified information data base and general programs. These program packs can be generated at any VTsKP for the required hardware configuration and composition of users. Work has been under way since 1980 to create a program production complex to develop user programs, introduction of which will make it possible to reduce considerably labor expenditures in programming of a specific class of user problems. Thus, the USSR Central Statistical Administration is undertaking the required measures for further creation and development of VTsKP.

However, a number of organizational and legal questions that regulate the activity of the VTsKP must solved, the typical proposition of the user station and its organizational and staff structure must be worked out and the lists of prices and tariffs for services of the VTsKP that take into account the specifics must be confirmed. Problems of standardization of teleprocessing

control programs and the computer process must be solved for all VTsKP, regardless of their agency affiliation, typical data bases and recommendations must be worked out on the use of data base management systems and the range of user problems and a unified system of encoding them must be worked out. The problem of training personnel in maintenance and operation of teleprocessing equipment and its programs has not yet been solved. One should also consider the problem of organizing centralized training of specialists and management workers of newly organized VTsKP.

Despite the existing difficulties in creation and functioning of VTsKP, the reporter said, the results achieved confirm the correctness of the concept of collective use of computer resources--one of the basic directions for increasing the efficiency of using computer equipment.

The experience of developing a material and technical base, programs, information and organizational and legal support of the first units of the VTsKP, the use of typical planning decisions inorganization of new VTsKP and the presence of highly qualified personnel is a reliable base for successful work in creation and introduction of VTsKP of the system of the USSR Central Statistical Administration into operation.

Candidate of Technical Sciences, department head of VNIIPOU [expansion unknown] V. Kvasnitskiy in his report "Typology of VTsKP and their design principles" specifically noted that the concept of VTsKP has now been determined as an independent production organization equipped with a complex of jointly functioning computers, data transmission equipment and a user network which, together with the corresponding programs and information support, permit users, regardless of their agency affiliation, to achieve collective use of computer resources, programs and information funds of the VTsKP. Simultaneous and independent servicing of users is provided in this case.

Seven primary VTsKP oriented toward solution of problems on the economic and social development of a region were created during the 10th Five-Year Plan. These centers were called territorial centers. Besides these centers, there can also be specialized VTsKP. The capability of implementing new progressive solutions is provided on this basis. Successful fulfillment of the extensive program of VTsKP development during the 11th Five-Year Plan requires serious scientific support on the part of fundamental research, improvement of design methods and automation of planning work.

The director of the republic VTsKP, Central Statistical Administration, BSSR N. Kononov gave a report "Development of the Minsk VTsKP and prospects for computer development in the Belorussian SSR." Creation of the first unit of the Minsk VTsKP and putting it into operation, he said, made it possible to increase considerably the quality and level of information support of management, planning and economic organizations of the republic and also to expand the capability of using modern computer equipment of enterprises and organizations, supplying of which with their own expensive computer equipment is economically unfeasible. Comrade Kononov further talked about the qualitatively new capabilities of the VTsKP and its task and then outlined the work of the Belorussian Branch of VGPTI, USSR Central Statistical Administration in development of the VTsKP.

The director of VGPTI, USSR Central Statistical Administration, Doctor of Technical Sciences E. Yevreinov was devoted to VTsKP and shared computer systems. Present-day VTsKP are the main link, he said, where many theoretical requisites should be checked and checked. Specifically, he considered one of the problems such as creation of shared data development at the VTsKP.

The economic problems of functioning of collective-use computer centers were outlined in the report of deputy chief of the Tula OIVTs [oblast information computer center] of State Statistics G. Dubinskiy. The presently existing system for planning production and economic activity of the VTsKP, he said, hardly differs from the planning system of ordinary cost-accounting computer centers, although organization of the production and economic activity of the VTsKP and computer center are different. The composition of the indicators and order of developing industrial financial plans of the VTsKP should be refined in this regard.

Development of stable long-term economic norms--wage norms per ruble of volume of work, norms of the number of personnel related to operation and maintenance not only of computers but of terminal devices, of personnel in accompanying systems software and applied program packs and personnel required to perform scientific planning work--is of the most important significance to improve planning of production and economic activity of the VTsKP since a large volume of work is performed at the VTsKP to investigate the effectiveness of their functioning, development of detail plans in programs, information support and hardware and so on.

An increase of the functional efficiency of a VTsKP largely depends on further development of cost accounting and intensification of the role of economic levers and stimuli in their activity, said Dubinskiy. Therefore, legal acts of the order of calculations with users must be confirmed for all services offered by the VTsKP.

The deputy department chief, Main Administration of Computer Equipment and Control Systems, GKNT, V. Makkaveyev, in his report "Organization of work to develop VTsKP during the 11th Five-Year Plan," considered the key questions related to functioning of these centers in the future.

Reports of the chief engineer of NII EVM [Scientific Research Institute of Computers] G. Smirnov, Candidate of Technical Sciences B. Panshin, deputy director of the Institute of Electronics and Computer Equipment, Latvian SSR Academy of Sciences V. Pilipeyko and the chief of the VTsKP of the Lengorispolkom Yu. Cherenkov also gave reports at the plenary session.

Six sesions worked at the conference: one in the methodology of design and economic and organizational-legal problems of VtSKP, one in problems in problems of users and improvement of regional management on the basis of VTsKP, one for hardware of VTsKP, one for software of VTsKP, one in the technology and information support of VTsKP and one in the user network of VTsKP and RVS.



6521
CSO: 1863/153

OBITUARY FOR ACADEMICIAN V. M. GLUSHKOV

Moscow PRAVDA in Russian 2 Feb 82 p 3

[Article: "Academician Viktor Mikhaylovich Glushkov"]

[Text] Soviet science has suffered a great loss. On 30 January 1982 after a grave and prolonged illness, Academician Viktor Mikhaylovich Glushkov died in his 59th year. He was an outstanding Soviet scientist, organizer of science, a member of the Central Committee of the Ukrainian Communist Party, a deputy to the USSR Supreme Soviet, a Hero of Socialist Labor, Winner of the Lenin Prize and the State Prizes of the USSR and Ukrainian SSR, vice president of the Ukrainian SSR Academy of Sciences, and director of the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences.

V. M. Glushkov was born in Rostov-na-Donu on 24 August 1923. After graduation from Rostov State University he taught at the Ural Forest Engineering Institute. The first period of his creative scientific work was devoted to development of timely aspects of modern algebra.

In 1956 V. M. Glushkov linked his scientific activities with the Ukrainian SSR Academy of Sciences. He was the founder and, until his death, only director of the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences, which became a major science center in a number of fields of cybernetics and computer technology.

V. M. Glushkov made a significant contribution to the development of pure research in the fields of mathematics, cybernetics, and computer technology. He formulated the theories of digital automata, discrete convertors, and macroconveyer computations which became part of the basis of the general theory of computing machines and systems. A number of domestic models of computer technology and control systems based on computers were developed under his direction. He was in charge of projects which proposed new technologies for designing machines and production of their basic elements, hardware and software complexes, and data processing systems. These developments found broad application in practice. For his outstanding scientific achievements he was elected an academician of the Ukrainian SSR Academy of Sciences in 1961 and an academician of the USSR Academy of Sciences in 1964.

V. M. Glushkov was an active teacher. He devoted constant attention to retraining managers and was a brilliant and tireless propagandist for the latest scientific advances. He always had a feeling for new things, and harmoniously combined the talent of a theoretical scientist with unusual capabilities in organizing the introduction of scientific advances in the economy.

He combined his scientific and teaching activities with a great deal of sociopolitical and science organizational work. V. M. Glushkov was elected a delegate to the 24th, 25th, and 26th party congresses and a deputy to the 8th, 9th, and 10th convocations of the USSR Supreme Soviet. He was a member of the USSR State Committee for Science and Technology and the Committee on Lenin State Prizes of the USSR Council of Ministers.

V. M. Glushkov was elected a foreign member of numerous foreign academies of sciences.

The Communist Party and Soviet State valued V. M. Gluskov's contributions to the homeland very highly. He was awarded the title Hero of Socialist Labor as well as three Orders of Lenin, the Order of the October Revolution, and various medals.

The lucid memory of the outstanding communist scientist Viktor Mikhaylovich Glushkov, a talented science organizer and remarkable man, will live forever in the hearts of Soviet people.

[signed] L. I. Brezhnev, A.P. Kirilenko, D. F. Ustinov, K. U. Chernenko, V. V. Shcherbitskiy, M. V. Zimyanin, L. V. Smirnov, G. I. Marchuk, A. F. Vatchenko, A. P. Lyashko, I. Z. Sokolov, A. P. Aleksandrov, B. Ye. Paton, S. P. Trapeznikov, I. F. Dmitriyev, E. K. Pervyshin, P. S. Pleshakov, M. S. Shkabardnya, A. I. Shokin, P. N. Fedoseyev, G. I. Vashchenko, V. F. Dobrik, Yu. N. Yel'chenko, B. V. Kachura, Ye. V. Kachalovskiy, I. A. Mozgovoy, A. A. Titarenko, I. A. Gerasimov, A. S. Kapto, Yu. A. Kolomiyets, Ya. P. Pogrebnyak, V. A. Sologub, A. A. Lugunov, V. V. Fedorchuk, V. A. Kotel'nikov, Ye. P. Velikhov, N. N. Bogolyubov, A. A. Dorodnitsyn, S. I. Gurenko, F. M. Rudich, K. M. Sytnik, V. I. Trefilov, Yul A. Mitropol'skiy, and V. S. Mikhalevich

11,176
CSO: 1863/122

## MINSK CONFERENCE OF LINGUISTS DISCUSSES COMPUTER APPLICATIONS

Moscow SEL'SKAYA ZHIZN' in Russian 29 Jan 82 p 4

[Article: "Find the Word in Your Pocket"]

[Text] The program for pocket computers developed by scientists at the Minsk State Pedagogical Institute of Foreign Languages combines the functions of interpreter and teacher. It not only provides speakers with the possibility of talking on any topic, but also corrects mistakes in one's own native language.

The linguistic software of the minicomputer includes three languages: Russian, English, and French. To carry on a conversation all one needs to do is put in the Russian phrase on the keyboard and it will immediately be shown on the screen, for example in English. The person you are talking to answers in his or her language, but what you read is written in Russian. The Minsk scientists turned their innovation over to the L'vov Radio Engineering Institute, where a pocket electronic interpreter is being developed.

This report aroused lively interest among participants at the all-Union Conference on text processing by engineering linguistics methods. The conference closed in Minsk on 28 January.

Linguists from the Kishinev Polytechnic Institute imeni S. Lazo also demonstrated an interesting project. Using the program they have developed the computer cannot translate the entire text (this would take too much time), but it can understand it and produce a brief statement of the basic points. The studies of Leningrad scientists, who are working on automation of translating pilot dialog with the ground will greatly simplify the work of traffic controllers at international airports.

Linguists, specialists at computer-producing enterprises, employees of computer centers, and mathematicians and programmers who came to Minsk devoted special attention to problems of introducing linguistic programs in practice.

11,176
CSO: 1863/122

UDC Δ 62-229.7.061.4

# AUTOMATIC MANIPULATORS EXHIBITED

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 4, Apr 82 pp 5-9

[Article by engineer V. I. Khar'kov]

[Text] The exhibition "Best models of automatic manipulators" changed its exhibits in the machinebuilding pavilion at VDNKh [Exhibition of Achievements of the National Economy] of the USSR (see MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA, No 6, 1981). A description of some of the presented exhibits is given in the article.

The Special Design Office of Engineering Cybernetics (OKB TK), Leningrad Order of Lenin Polytechnical Institute imeni M. I. Kalinin is conducting significant work in the field of developing automatic manipulators (AM). Some developments of this OKB are described below.

The MP-11 automatic two-arm manipulator is designed for use in metalworking, in machine tools, presses, in assembly operations and also in other operations where parts or tools must be transferred with given accuracy.

The extension of the arms of the automatic manipulator can be simultaneous and separate. One arm has a rotary grasping mechanism and the other is equipped with a mechanism for horizontal movement of reach.

A control device links the automatic manipulator to the production equipment and permits the complex to operate in automatic and manual modes.

Specifications of MP-11 Automatic Manipulator

| | |
|---|---|
| Load capacity of arm, kg | 1 |
| Number of degrees of movement | 6 |
| Accuracy of positioning, mm | ±0.05 |
| Movements of arms: | |
| raising, mm | 65 |
| extension, mm | 200 |
| turn, deg | 120 |
| rotation of grab, deg | 180 |
| horizontal movement of grab, mm | 25 |

| | |
|---|---|
| Rotation of arms, deg | 20-100 |
| Drive | pneumatic |
| Air pressure, $kgf/cm^2$ | 4 |
| Control | cyclic |
| Number of production instructions | 6 |
| Overall dimensions, mm: | |
| of manipulator | 829 X 845 X 468 |
| of control device | 480 X 435 X 220 |
| Mass, kg: | |
| of manipulator | 70 |
| of control device | 26 |

The cost of the automatic manipulator (approximate) is 8,000 rubles and the saving from introducing it is 5,000 rubles. The use of the MP-11 automatic manipulator increases labor productivity up to 40 percent and frees two workers.

The MP-12 automatic manipulator (Figure 1) is designed to move small parts in a special package and is also designed for use in intrashop transport systems.

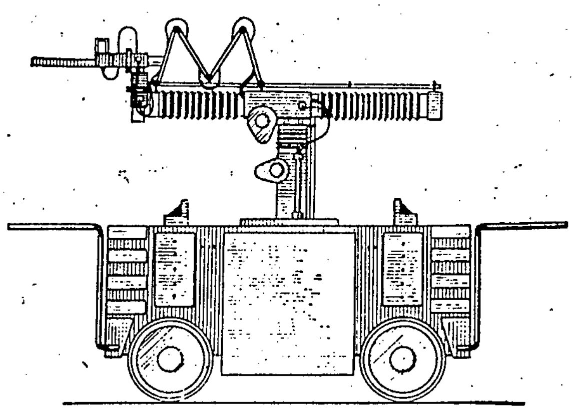

Figure 1. MP-12 Automatic Manipulator

The automatic manipulator in the automatic mode performs loading-unloading operations at the warehouse and at jobsites, movement along a route without mechanical guides, selection and identification of a servicing object and electronic correction of its position near the servicing object.

Specifications of MP-12 Automatic Manipulator

| | |
|---|---|
| Version of manipulator | modular |
| Load capacity, kg | 20 |
| Load capacity of cargo platform, kg | 200 |
| Number of degrees of motion | 6 |
| Speed, m/s | 0.7 |
| Type of drive | electromechanical |
| Control device | adaptive, based on Elektronika-6 microcomputer |
| Number of serviced objects | up to 62 |
| Method of movement | floor, railless |

| | |
|---|---|
| Power supply | storage battery |
| Capability of continuous operation, hr | 8 |
| Overall dimensions of automatic manipulator carriage, mm | 1,500 X 100 X 1,500 |

The automatic manipulator frees four-five persons per shift.

The MP-9S automatic manipulator (Figure 2) is designed for automation of loading and unloading operations and can be used to service presses and in assembly operations where parts or tools must be transferred within the working zone of the manipulator with given positioning error.

The control device ensures communication of the automatic manipulator with the equipment to be serviced and operation of the entire complex in the automatic and manual modes

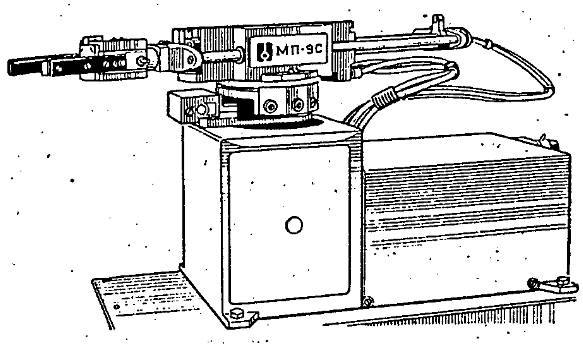


Figure 2. MP-9S Automatic Manipulator

Specifications of MP-9S Automatic Manipulator

| | | |
|---|---|---|
| Manipulator: | | |
| load capacity (including mass of grab), kg | | 1 |
| number of degrees of movement | | 3 |
| number of positioning points for each degree of movement | | 2 |
| positioning error, mm | | $\pm 0.05$ |
| Movements: | | Speeds : |
| raising, mm | 30 | 100 mm/s |
| extension, mm | 150 | 500 mm/s |
| rotation, deg | 210 | 240 deg/s |
| air pressure | | 4 $kgf/cm^2$ |
| Control system | | cyclic |
| Number of production instructions | | 6 |
| Overall dimensions, mm | | |
| of manipulator | | 630 X 232 X 305 |
| of control device | | 480 X 435 X 220 |
| Mass, kg: | | |
| of manipulator | | 36 |
| of control device | | 26 |

The cost of the MP-9S automatic manipulator is 6,900 rubles and the saving from introducing it is approximately 3,000 rubles. Use of the MP-9S automatic manipulator frees one worker.

The MP-5P automatic manipulator (Figure 3) is designed to service metal cutting machine tools, press equipment, for use in assembly operations, spot welding and so on.

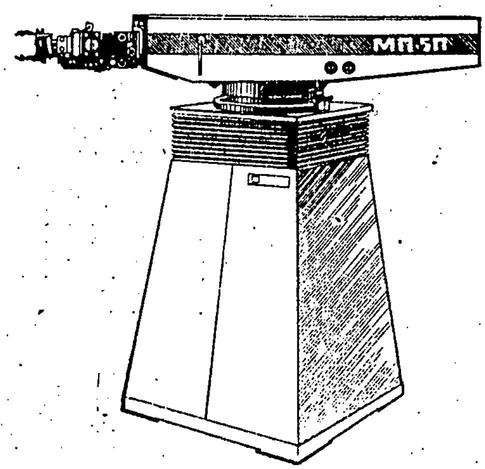


Figure 3. MP-5P Automatic Manipulator

The automatic manipulator is a floor type, general-purpose and pneumatic with positional control system.

There are five controlled pneumatic channels to control the grab device.

Specifications of MP-5P Automatic Manipulator

| | | |
|---|---|---|
| Manipulator: | | |
| load capacity, kg | | 20 |
| number of degrees of mobility | | 5 |
| among them with positional control | | 3 |
| Movements: | | Speeds: |
| raising, mm | 250 | 250 mm/s |
| extension, mm | 600 | 1,000 mm/s |
| rotation, deg | 270 | 90 deg/s |
| Positioning error, mm: | | |
| in positional mode | | ±1.5 |
| in cyclic mode | | ±0.1 |
| Delivery pressure, kgf/cm$^2$ | | 4 |
| Mass of manipulator, kg | | 510 |
| Overall dimensions, mm | | 600 X 600 X 1,300 |

The control device has a memory capacity of 512 16-digit words, which corresponds to notation of 512 positions by one coordinate.

| | |
|---|---|
| Overall dimensions of control device | 1,200 X 380 X 420 mm |
| Mass, kg | 80 |

The ETsPU-6030 control device is designed to control manipulators with positioning by supports and the accompanying equipment for automation of transport operations and various production processes in forge-press and other production.

The device is built on the synchronous programmed automaton principle with rigid control cycle. The operating program of the manipulator and production equipment is based on multiposition flat switches. The device guarantees control of the electromagnets of valves with rating up to 10 W with DC voltage of 24 V.

Specifications of EtsPU-6030

| | |
|---|---|
| Type of system | cyclic |
| Number: | |
| of controlled coordinates (including grabs) | 6 |
| of simultaneously controlled coordinates | 2 |
| of positioning points by coordinate | 2 |
| of production instructions | 6 |
| of interlocks | 4 |
| of program frames | 30 |
| Power supply voltage of device | 220 V, 50 Hz |
| Consumed power, kVA | 0.1 |
| Mass of device, kg | 25 |
| Overall dimensions, mm | 480 X 435 X 220 |

The device is made in the form of a metal floor console. The electronic units are made in the form of plates with two-sided printed-circuit installation. The component base is silicon integrated microcircuits of medium degree of integration of series K155.

The device is manufactured serially at AvtoVAZ [expansion unknown] (Togliatti) and at enterprises of Leningrad.

The cost of the device is 3,000 rubles.

The YeSM-02 positional modular control device is designed to control automatic manipulators of different designation having electrohydraulic or electric tracking drives and potentiometric (analog) sensors of the positions of manipulator sections.

The YeSM-02 numerical control device is designed on the principle of a synchronous programmed automaton with rigid control cycle.

Functionally, the device consists of structural modules which guarantees the possibility of variation and increase of the functions and parameters of the device as a function of the type of automatic manipulator, the composition of the external equipment and also the capability of asynchronous control of several manipulators (group control).

Specifications of YeSM-02

| | |
|---|---|
| Type of control system | Positional |
| Number of controlled coordinates | 8 (with capability of increasing to 32 with group control) |
| Memory capacity | 512 instructions (with capability of increasing to 4,096) |
| Time delay | 0-400 seconds with discretenesss of 0.1 second |
| Positioning accuracy | Up to $1/3^{13}$ |
| Number of inputs from external equipment | Up to 48 |
| Capability of Placing in regulation packaging (or stacking) | Available |
| Number of control signals to external equipment | 64 |
| Display | Memory address, memory contents, error during positioning, positioning of manipulator sections (sequentially) |
| Consumed power, kVA | Up to 0.25 |
| Overall dimensions, mm | 380 X 400 X 1,200 |
| Mass, kg | Up to 100 |

The device consists of a metal cabinet and teaching console connected to it through a plug with cable not more than 10 meters long. The electronic units are made in the form of modules on cards with two-sided printed-circuit installation. General installation is by the twisting method. The component base is large and medium integrated circuits in combination with digital components.

The UTsM-663 control device is designed to control an automatic manipulator with positioning by supports and the accompanying production equipment under small-series and series-production conditions. The device is designed on the principle of a synchronous programmed automaton with rigid control cycle. The operating program in the form of a sequence of instructions is formulatd and entered in the memory unit from a decimal keyboard located on the operator's console. The memory unit guarantees storage of operating programs with the power switched on. The contactless output amplifiers guarantee control of the actuating components (electromagnets of valves) with rating up to 50 W for DC voltage of 24 V or AC voltage of 110 V.

The device can be connected to a manipulator with any logic connection of valves of the hydraulic or pneumatic circuit.

Specifications of UTsM-663

| | |
|---|---|
| Type of system | cyclic |
| Number of controlled coordinates | 6 |
| Number of two-position controlled coordinates can be increased with control by time principle | Up to 12 |
| Number of positioning points: | |
| by two coordinates | 8 |
| by eight coordinates | 4 |
| Number of controlled grabs | 2 |

| | |
|---|---|
| Number of instructions to external equipment | 12 |
| Delay time, seconds | 15 |
| Memory capacity | Up to 224 single instructions |
| Number of programs located simultaneously in memory | Up to 4 |
| Power supply voltage of device | 380 V, 50 Hz |
| Mass of device, kg, no more than | 110 |
| Overall dimensions, mm | 1,250 X 575 X 480 |
| Consumed power, kVA, no more than | 0.6 |

The device consists of a metal cabinet and manual control console connected to it through a plug with shielded cable not more than 10 meters long. The microelectronic units are structurally based on two-sided printed-circuit cards. General installation is by the twisting method. The use of silicon integrated microcircuits of series K155 guarantees high operating reliability of the device and adequate noise resistance.

The device is manufactured serially by the Lubna Calculator Plant, Poltavskaya Oblast. The cost of the device is 5,700 rubles.

The automatic manipulator with program control (AMPU) (Figure 4) is designed for loading-unloading single billets in the working space of single-crank sheet-stamping presses with force of 100-160 tons and other vertical stamping equipment in automatic complexes or automatic lines.

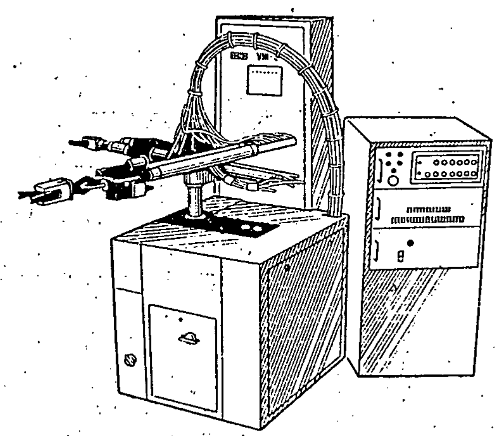

Figure 4. Automatic Manipulator with Programmed Control (AMPU)

The AMPU consists of a two-arm manipulator with pneumatic drives of the actuating mechanisms and a fluid cyclid programmed control system in a separate unit.

The automatic manipulator, operating in a cylindrical coordinate system, performs three grab motions: longitudinal up to 800 mm, vertical up to 150 and rotational around the vertical axis up to 180°. Moreover, rotation of one of the grabs around the horizontal axis in the range of 180° is possible.

Depending on the configuration of the blanks and articles to be transported, the automatic manipulator is equipped with different grabs: pneumatic (vacuum), pneumomechanical and electromagnetic.

Specifications of AMPU

| | |
|---|---|
| Maximum load capacity (with mass of grab up to 2.5 kg), kg | 10 |
| Maximum mass of blank transported by one arm, kg | 5 |
| Angle between axes of arms, deg | 0-90 |
| Maximum speed (with mass of blank or article up to 2.5 kg): | |
| longitudinal, m/s | 1.5 |
| vertical, m/s | 0.5 |
| rotational, deg/s | 180 |
| Positioning accuracy of arm in horizontal plane, mm | $\pm 0.1$ |
| Working air pressure in system, $kgf/cm^2$ | 4.5-5.0 |
| Overall dimensions in layout (body), mm | 830 X 740 |
| Mass, kg | 550 |
| Fluid system of cyclic programmed control | |
| Program control principle | Time |
| Program carrier | Plug panel |
| Method of program selection | Commutation |
| Length of on-off cycles, seconds | 0.1-3.0 |
| Number: | |
| of on-off cycles | 25 |
| of leads | 30 |
| Power supply source | Blower |
| Overall dimensions in layout, mm | 600 X 650 |
| Mass, kg | 110 |

The automatic manipulator can be used in automated complexes in cold stamping operations from unit sheet blanks (broaching, cutting, shallow extrusion, bending, crimping, contour edging and so on).

The complex performs the following operations: grasping of blank from initial position and transfer of it to working zone of press, placing blanks in die, stamping of article, removal of stamped article (and contour edging) from working zone of press and placing article (and contour edging) into packaging.

The blank is brought to the initial position by magazine or cassette-oriented devices.

Trouble-free operation is guaranteed by external information sensors which include: two blanks entering the die, operation of press with grab in the stamping zone, with incorrectly placed blank or in case stamped article is not removed from die and movement of grabs into stamped zone if press slide is in upper dead point.

Introduction of the complex increases labor productivity by an average of 50 percent, frees workers from monotonous labor and increases production skills.

The national economic saving from introduction of one complex with multimachine servicing is 14,000 rubles.

Use of the automatic manipulator is most effective in automatic lines based on crank presses.

The developer of the AMPU and of the magazine device is ENIKmash [Experimental Scientific Research Institute of Forging and Pressing Machinery].

The developer of the programmed control system is the Volga Branch of VNIIASh [All-Union Scientific Research Institute of Abrasives and Grinding].

The manufacturer of the AMPU is the Barnau Mechanical Press Plant.

A manipulator for forging rolls (Figure 5) is designed for feeding blanks into the working zone of the rolls, transportation of them from pass to pass and delivery of rolled blanks.

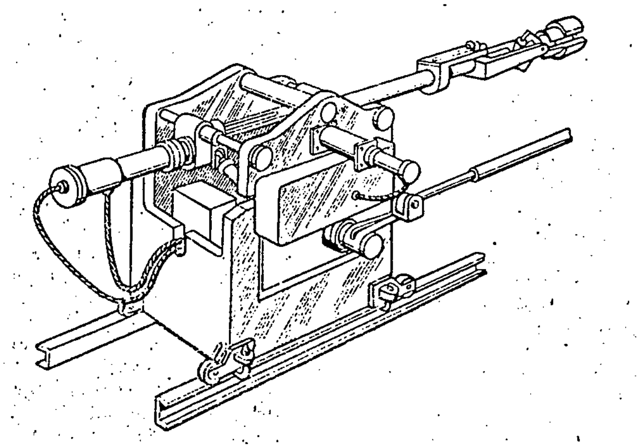

Figure 5. Manipulator for Forging Rolls

The manipulator is operated jointly with forging rolls whose intercenter distance is 400 and 500 mm.

Specifications of Manipulator

| | |
|---|---|
| Load capacity, kg | 50 |
| Number of grab devices (tongs) | 1 |
| Number of degrees of mobility of arm | 3 |
| Height of longitudinal axis of arm above floor level, mm | 1,050 |
| Extent of longitudinal movement of manipulator, mm | 300$\pm$5 |
| Greatest longitudinal path of arm, mm | 884 |
| Transverse path of grab, mm | 157.5 |
| Greatest number of working (longitudinal) passes of grab, passes/min | 60 |
| Angle of rotation of blank, deg | 90 |
| Greatest number of roller passes | 4 |
| Longest length of rolled blank, mm | 765 |

| | |
|---|---|
| Greatest cross-sectional dimensions of initial blank, mm | 100 |
| Overall dimensions in layout, mm | 3,500 X 2,000 |
| Mass, kg | 2,500 |

The annual saving from introduction of the manipulator to forging rolls is 42,000 rubles.

The developer and manufacturer of the experimental model is PKTIkuzrobot [Planning and Design Technological Institute of Forging Robots], Taganrog.

The complex (Figure 6) is designed for hot stamping of part blanks of the bolt, axle, pin and other type.

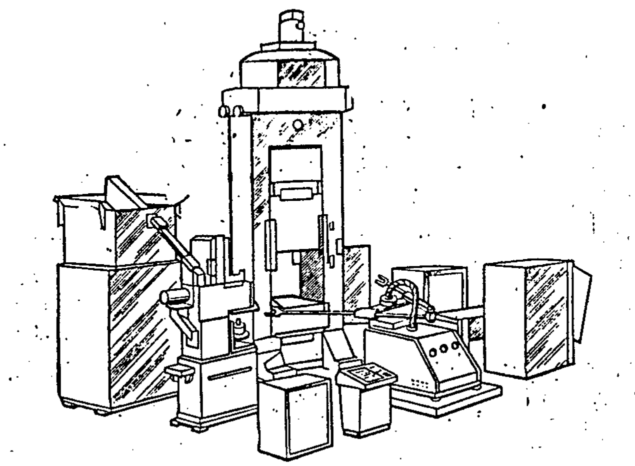

Figure 6. AKFB1732A-1 Automated Complex

The composition of the complex is a screw press, automatic manipulator, loading device, proportioning device, device for blowing scale and lubricants of die and installation for heating blanks.

The following functions are performed automatically on the complex: unit delivery of blanks from a hopper and orientation of them, heating of blanks, installation of blanks in press die, stamping of blanks, removal of forgings from die to packing, blowing away of scale and lubrication and cooling of die.

Specifications of Complex

| | |
|---|---|
| Nominal force of press, tons | 160 |
| Greatest mass of blank, kg | 0.63 |
| Positioning accuracy, mm | $\pm 0.1$ |
| Overall dimensions, mm | 400 X 3,700 X 3,925 |
| Mass, tons | 15 |
| Productivity, parts/min | 10 |

The annual saving from introduction of the complex is 63,000 rubles.

The developer and manufacturer of the experimental model is the PKTIkuzrobot, Taganrog.

The hoisting-transport complex with capacity of 500 kg (Figure 7) was developed for the Druzhkov Machine Plant on the basis of an overhead automatic manipulator with one arm and is designed to transfer blanks in universal packing for all jobsites of the section to be serviced in a given sequence.

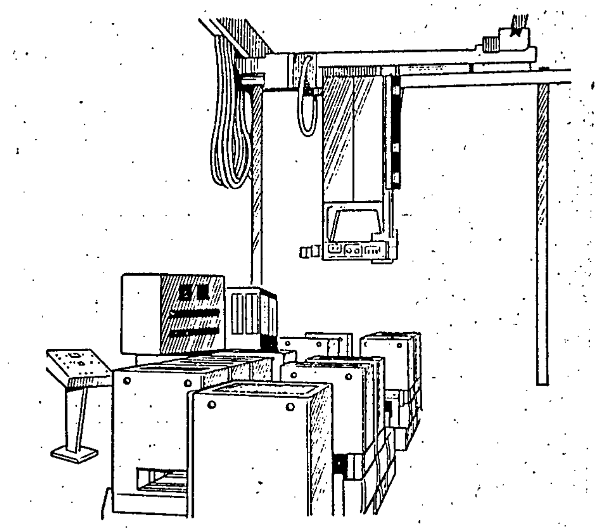

Figure 7. Hoisting-Transport Complex

The complex includes an automatic manipulator, roller conveyors and control system. The automatic manipulator places packaging with blanks to the first request position, the second position is intended for location of free packaging, the third position is intended for storing the finished parts and the fourth position is intended for arranging the filled packing with machined parts, which is then collected by the automatic manipulator. The first and fourth positions are supplied with sensors that emit a signal to request blanks and to remove finished parts.

The control system can operate in two modes. In the automatic mode the packaging is transported to all positions according to the program selected on punch cards. In the remote semi-automatic control mode, the set of addresses and the program for moving the automatic manipulator are set by the section dispatcher according to signals coming from the jobsites.

Brief Specifications of Complex

| | |
|---|---|
| Load capacity, kg | 500 |
| Number of serviced positions | 20 |
| Speed, m/s | 0.2-0.6 |
| Positioning accuracy, mm | $\pm 10$ |
| Mass of automatic manipulator, kg | 3,500 |

The experimental model of this complex was manufactured and tested in 1978 at the Istra Experimental Plant of VNIIPTUglemash [All-Union Scientific Research, Planning and Technological Institute of Coal Machinery].

The MP-100 electromechanical loading manipulator (Figure 8), balanced type, is designed to transfer and install freight with mass up to 100 kg. The different grabs of the manipulator are interchangeable. The MP-100 manipulator can be used for loading-unloading operations in assembly, mechanical, thermal and other shops.

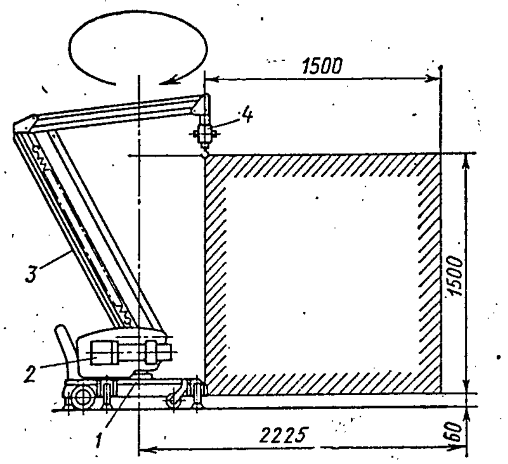


Figure 8. MP-100 Electromechanical Loading Manipulator:
1--carriage; 2--power drive; 3--lever mechanism; 4--freight unit

Specifications of MP-100 Manipulator

| | |
|---|---|
| Load capacity, kg | 100 |
| Maximum vertical and horizontal movement, mm | 1,500 |
| Angle of rotation around vertical axis, deg: | |
| of lever mechanism | 360 |
| of freight unit | 360 |
| Maximum vertical speed, mm/s | 200 |
| Regulation of vertical speed | Stepless |
| Consumed power, kVA | 1 |
| Area of carriage, mm | 1,260 X 1,050 |
| Mass of manipulator without carriage, kg | 200 |

Versions of the MP-100 loading manipulator are shown in Figure 9.

The KSh-63 manipulator (Figure 10) with automatic load equalization is designed to eliminate heavy manual labor when performing interoperational, assembly, loading-unloading, transport and warehouse work.

The smoothness and operating accuracy of the manipulator permit transportation of fragile objects. The load is equalized at any point of the servicing zone.

Specifications of KSh-63

| | |
|---|---|
| Load capacity, kg | 63 |
| Servicing zone, mm: | |
| in height | 1,600 |
| in radius | 300-3,000 |

| | |
|---|---|
| Rotation around axis of column, deg | 360 |
| Air pressure in pneumatic system, kgf/cm$^2$, not less than | 3.5 |
| Force of moving part, kgf: | |
| along vertical | 5 |
| along horizontal | 2 |
| Air consumption when hoisting load to height of 1 meter, liters | 15 |
| Overall dimensions, mm | 2,655 X 600 X 3,000 |
| Mass, kg | 324 |

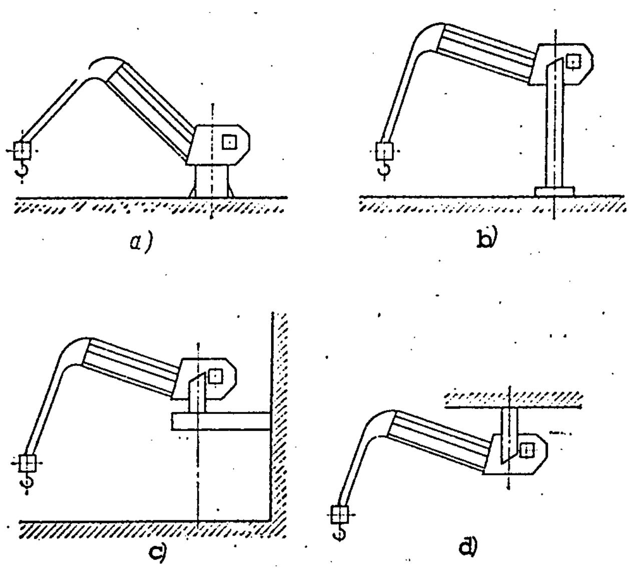


Figure 9. Versions of MP-100 Loading Manipulator: a--installation on floor on base; b--installation on floor on column; c--attachment to wall on bracket; d--attachment to ceiling

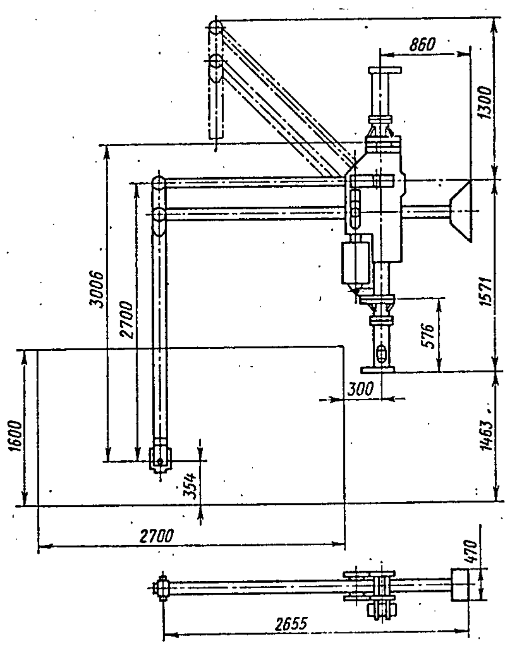


Figure 10. KSh-63 Manipulator

The manufacturer is the NPO [Scientific Production Association] Kompleks.

The KSh-160M1 manipulator is designed to eliminate heavy manual labor and to increase productivity in interoperational transfers of parts and loading-unloading, transport, warehouse and assembly operations. It is supplied with an automatic load equalizing system with pneumatic drive that guarantees easy and smooth movement of loads.

Specifications of KSh-160M1

| | |
|---|---|
| Load capacity, kg | 125 |
| Force when moving nominal load, N, not more than | |
| along horizontal | 40 |
| along vertical | 60 |
| Service zone, meters: | |
| in height | 0-1.6 |
| in radius | 0.3-3.0 |
| Air pressure fed to manipulator, kgf/cm$^2$ | 4.5-6.3 |
| Speed of raising and lowering load by manipulator, m/s | 0.05-0.50 |
| Overall dimensions, mm | 3,870 X 2,735 X 720 |
| Mass of manipulator, kg | 465 |

The versions of the manipulator are shown in Figure 11. The developer and manufacturer is the NPO Kompleks.

Correlation vision (KZ) for the automatic manipulator is designed to analyze visual information for determining linear (positional) coordinates, angular orientation of a part and recognition of parts in the plane of the conveyor.

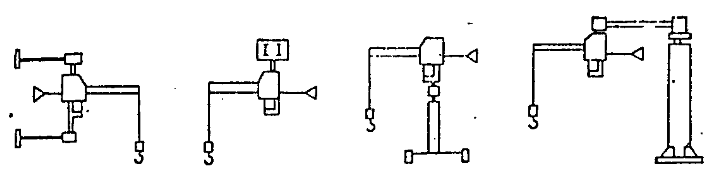

Figure 11. Versions of KSh-160M1 Manipulator

The operating principle of the correlation vision is based on the correlation-extreme method of comparing two images: moving (TI) and reference (EI). The moving image is formed by means of a KTP-40 television camera and corresponds to the current position of the part, while the image of this same part in the required position is used as the reference image. The system, shown in Figure 12, functions cyclically.

The cycle includes the following operations: recording of a new image on the screen of a cathode-ray tube storage device (ZELT), combination of the compared images by the angle of their relative rotation--determination of the angular orientation of the part, recognition of parts, estimate of the coordinates of parts in a rectangular system, scaling and display of the values and erasure of the image reproduced by the ZELT. A video signal and pulses

for starting of line and frame scanning are fed to the system from a video camera. The signal image converter from the control unit of the operating modes processes the moving image representation in the form of a contour, combination of points or inventory of the moving image.

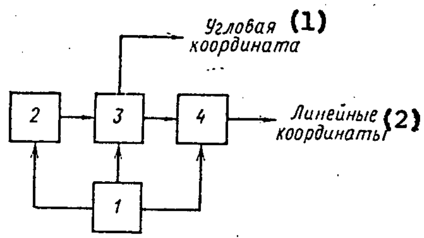


Figure 12. Block Diagram of Correlation Vision (KZ): 1--control unit of operating modes; 2--video camera; 3--optical image comparison unit; 4--coordinate recalculation unit

Key:
1. Angular coordinate
2. Linear coordinates

The cross-correlation function (VKF) between the TI and EI is formed by a modified Meier-Eppler correlator. The optical image of the cross-correlation function is converted by a television camera tube into a sequence of electric signals. The moving and reference images are combined by angle by the rotational actuating unit of the reference image with line-frame inspection of the image plane of the cross-correlation function and continuous rotation of the reference image around the optical axis of the correlator. The angular coordinate is determined by the unit for estimating the angular coordinate, which contains a rotary perforated disk and a rotary sine-cosine transformer. The "identification" operation is accomplished on the basis of analyzing the normalized correlation function. The rough values of the linear coordinates found as a result of continuous rotation of the reference image are refined by the coordinate recalculation unit by recalculation of the coordinates to a coordinate system bound to the reference image.

The system is made in the form of a device (image comparator) and rack for a television camera. A reference image measuring 24 X 36 mm is installed in the correlator frame. The image comparator is made on the basis of semiconductor devices and microcircuits.

Correlation vision, being a new type of visual systems for automatic manipulators, has high accuracy, reliability, noise resistance and low cost.

The use of correlation vision is most effective in development of adaptive automatic manipulators. Correlation vision can function with horizontal, vertical, continuous and pulsating conveyors.

The accuracy of determining the linear coordinates of parts as a function of their shape comprises 3-5 percent of the value of the permissible shift of the

part in the plane of the conveyor. The accuracy of determining the angular orientation of the part is 2-3° with rotation of the part by 360°. The length of the cycle for determining the coordinates is 0.6 second. The consumed power is 200 W. The overall dimensions of the image comparator are 230 X 640 X 415 mm. The mass is 50 kg.

Correlation vision for automatic manipulators was developed at the Siberian Order of Red Banner of Labor Physicotechnical Institute imeni V. D. Kuznetsov.



6521
CSO: 1863/164

## PUBLICATIONS

### CONTENTS OF 'CONTROL MECHANIZATION AND AUTOMATION', JANUARY-MARCH 1982

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 1, Jan-Mar 82 p 65

[Text] Contents

11004
CSO: 1863/140

ABSTRACTS OF ITEMS IN JOURNAL 'AUTOMETRY', JANUARY-FEBRUARY 1982

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 82 pp 109-113

UDC 681.327.521

PHOTOMETRIC DEVICE OF SKAN-2 SYSTEM

[Abstract of article by Potashnikov, A. K. and Sitnikov, G. F.]

[Text] A computer-controlled two-beam photometric device is described. A cathode-ray tube is used as a light source. An additional light source used to calibrate the photometric channel is employed to eliminate the effect of photodetector instabilities on the results of measuring optical density. A block diagram of the device is presented and its operation is described. The effect of photodetector noise on the accuracy of measuring optical density is considered.

UDC 621.391:681.3:620.179.1

HYBRID OPTO-ELECTRONIC IDENTIFICATION SYSTEMS OF FLAW DETECTION CHECKING OF RADIO ARTICLES

[Abstract of article by Rozin'kov, N. S.]

[Text] The block diagram of a hybrid opto-electronic identification system that performs flaw detection checking of radio particles (ERI) and visualized display of them was developed on the basis of analyzing the areas of application of machine identification methods, data on optical identification systems (RS) and future development and application of hybrid opto-electronic identification systems. Specific examples of identification systems designed for flaw detection checking of radio parts and images of them are presented.

UDC 621.373.826

USE OF SCATTERING METHOD TO PROCESS TWO-PHASE HOLOGRAMS

[Abstract of article by Bykov, V. N., Yertanova, O. N., Zuyev, Yu. V., Lavrent'yev, M. Ye. and Lepeshinskiy, I. A.]

[Text] The applicability of the light-scattering method at small angles to processing holograms to find the integral characteristics of a two-phase flow with medium and large concentrations (up to $10^6$ $cm^{-3}$) is shown. The results of processing the holograms of a water-air jet at different gas velocities are presented. The results of processing by the scattering method from the hologram and directly from the flux are compared to visual observation from a hologram.

UDC 620.17:535.512

PRACTICAL METHODS OF RECORDING AND INTERPRETATION OF HOLOGRAPHIC INTERFEROGRAMS THAT PROVIDE THE REQUIRED ACCURACY OF DETERMINING THE STRAIN TENSOR COMPONENTS

[Abstract of article by Borynyak, L. A., Gerasimov, S. I. and Zhilkin, V. A.]

[Text] It is suggested that the recording medium be attached to the surface of the specimen to be investigated to reduce the requirements on the vibration isolation of the experimental circuits. Holographic interferograms are recorded in the oncoming beams to increase the accuracy of determining the displacement vector components. Solving equations are presented that permit independent determination of the displacement vector components and the strain tensor components for the case of the plane problem. The suggested method is illustrated by examples of solving plane problems with static and cyclic loading of specimens on standard test machines.

UDC 621.382

PAGE FORMER FOR HOLOGRAPHIC STORAGE DEVICES

[Abstract of article by Yelkhov, V. A., Klimov, I. I., Levchenko, I. V., Mazur, A. I., Morozov, V. N., Semochkin, P. N., Trykin, B. S. and Shidlovskiy, R. P.]

[Text] The operation of a page forming device based on a liquid-crystal matrix with electrically controlled light scattering measuring 32 X 32 is described. The operating mode of the device was optimized to increase the optical contrast, which comprised 60:1 with page formation time of 1.85 seconds. The wide working band of wavelengths, the high transmission of the valves $t_{k1} = 0.7$ and the presence of internal masking make the use of the matrix promising for holographic recording. This is confirmed by the holograph recorded with semiconductor and helium-neon lasers.

UDC 681.327.2

THEORY OF ASSOCIATIVE MEMORIES WITH DISTRIBUTED INFORMATION RECORDING

[Abstract of article by Solomatin, V. F.]

[Text] An analytical description of a new type of storage devices is given. Evaluations of the capacity are found, the functional capabilities are considered, the block diagrams of the devices are presented and the range of their application is indicated. The results of computer modelling of the devices are discussed.

UDC 7.784

INVESTIGATING THREE-DIMENSIONAL IMAGES OBTAINED BY MODULATION HOLOGRAPHY METHOD

[Abstract of article by Morozov, S. V.]

[Text] The distortions arising in an image restored by a modulation hologram are considered. The results of calculating the scattering diagrams of diffuse-scattering cylindrical bodies are presented.

UDC 528.56

METHODS OF REDUCING EFFECT OF RESIDUAL GAS DRAG IN BALLISTIC LASER GRAVIMETER

[Abstract of article by Stus', Yu. F.]

[Text] Methods of measuring the acceleration of gravity that permit one to reduce the systematic error of measurements caused by the resistance of the incident body from the direction of the residual gas in the chamber are considered.

UDC 543.51:681.3.004

PROGRAM OF AUTOMATED PROCESSING OF PHOTO MASS SPECTRA

[Abstract of article by Gavrikov, I. A., Ryabchun, A. Yu. and Trubacheyev, G. M.]

[Text] Operation of the SUE program designed to calculate the spark photo mass spectra in the automatic identification mode is described and illustrated. The program is an integral part of the system that includes a mass spectrograph based on the Mattauch-Herzog circuit and also a microdensitometer and graphic display controlled by a M-6000 computer.

UDC 519.1:519.2:62-529

PROBLEM OF ESTIMATING BOUNDARY VALUES OF LABORIOUSNESS OF ALGORITHMS

[Abstract of article by Znak, V. I.]

[Text] The problem of estimating the boundary values of the laboriousness (implementation time) of algorithms and machine programs is considered. This problem can be solved by using both algebraic and network approaches. The capabilities of the corresponding methods in the noted plan are analyzed and it is proved that the use of the network method compared to the algebraic method permits one to obtain stronger estimates in the case when the investigated algorithm has more than one implementation branch (or version). A numerical example is considered.

UDC 535.317.1:535.55

APPLICATION OF MATRIC FORMALISM TO PARTIAL ANALYSIS OF OPTICAL SYSTEMS HAVING DOUBLE BEAM REFRACTION

[Abstract of article by Trubayev, V. V.]

[Text] Matrix formalism that permits one to write the relations between a coherent transfer function, optical transfer function and point scattering function in standard form is used for partial analysis of optical systems having double beam refraction.

UDC 681.327.12

STATISTICAL ANALYSIS OF PARAMETERS OF DISCRETE MODELS OF PLANE CURVES

[Abstract of article by Kipot', V. L.]

[Text] The method of estimating the parameters of models of plane curves obtained during quantification from the nonstatistical characteristics of a set of input curves is considered. The results can be used to analyze and select methods of quantification and encoding and also to estimate the parameters of graphic image processing systems.

UDC 681.786.52:62.426

MEASURING-INFORMATION SYSTEM FOR MONITORING AND ANALYSIS OF ACCURACY OF MANUFACTURING LENGTHENED MICRO-OBJECTS

[Abstract of article by Aleksandrov, V. K., Biyenko, Yu. N. and Il'in, V. N.]

[Text] The developed measuring-information system for monitoring and analysis of the accuracy of manufacturing lengthened micro-objects based on the suggested interference-shadow method of monitoring that utilizes splitting of the object image having increased resolution is described. The structure and functional capabilities of a specialized computer are considered.

UDC 576.8.074:681.3

CAPABILITIES OF CLASSIFYING BIOLOGICAL OBJECTS BY MORPHOLOGICAL FEATURES BY FOURIER MICROSCOPY AND OPTICAL INFORMATION PROCESSING METHODS

[Abstract of article by Sladkov, O. S. and Shchukin, I. V.]

[Text] The capabilities of classifying biological objects by three-dimensional spectra are considered. The experimental results are related to blood cells, leucocytes (fixed preparations) and live micro-organisms.

UDC 612.041.421+577.3.08+577.352.3

UNIT FOR RECORDING VOLTAGE ON CELL MEMBRANE

[Abstract of article by Bush, A. V. and Koshcheyev, L. N.]

[Text] A unit for recording the voltage on cell membranes, designed to investigate the kinetics of ion currents transmitted by means of an automation system based on a minicomputer and CAMAC apparatus, is described. The scheme suggested in the paper is realized on integrated microcircuit and permits one to verify the parameters of the microelectrodes used and to monitor their introduction into the cell, automatic connection of the voltage and current recording modes (from the system) and calibration of pre-amplifiers and membrane current meter.

UDC 681.2.088

DATA COMPRESSION FOR CORRECTION OF READINGS OF MEASURING INSTRUMENTS

[Abstract of article by Shchadilov, A. Ye.]

[Text] The problem of minimizing the volume of data which must be stored in the memory of a microcomputer when making numerical corrections of systematic measurement errors is considered. The versions of the algorithm for compressing the initial experimental data are described.

UDC 519.246

INVESTIGATING AUTOCORRELATION OF IMAGES BY SCALING, ROTATIONS AND SHIFTS

[Abstract of article by Buymov, A. G. and Guymova, N. A.]

[Text] The relationship between autocorrelation functions of images is established with respect to shifts and angular and scale correlation functions. Formulas of their unbiased estimation are found. The theoretical results are confirmed by experiment.

UDC 621.391

MODEL OF SIGNAL INTERPOLATION BY DIGITAL READINGS

[Abstract of article by Galitskas, A. A.]

[Text] A model for interpolation of signals nonfinite in spectrum by their digital samples, in which the universal basic function differing from the classical function is used, is proposed. It is shown that the basic function is close to the optimum function when accurate approximation of the drop of the energy spectrum of the signal by a straight line in possible.

UDC 535.317.1:535.55

MATRIX DESCRIPTION OF COHERENT LIGHT DIFFRACTION ON SLIDE THAT SPATIALLY MODULATES AMPLITUDE, PHASE AND POLARIZATION OF LIGHT

[Abstract of article by Trubayev, V. V.]

[Text] The use of matrix formalism to describe the diffraction of coherent light on a slide that spatially modulates the amplitude, phase and polarization of light is considered.

UDC 535.42.581.3

INTERPRETATION OF PATTERNS FOUND BY SHADOW METHODS WITH HIGH PERCENTAGE MODULATION OF WAVE PHASE

[Abstract of article by Gorodetskaya, V. I., Kosoburd, T. P. and Markus, F. A.]

[Text] The intensity distribution pattern found in the observation plane by the shadow field or phase contrast method with high percentage modulation of the wave phase passed through a transparent structure permits clear determination of the phase dependence on the coordinates at all points, except those where the phase is a multiple of $\pi$. Any of these methods permits duality in determination of the dependence of the phase in the vicinity of the indicated points at those points where the phase is equal to $m\pi$. One method must be used in combination with the other to eliminate the indicated ambiguity.

UDC 681.325.088.8

STRUCTURE OF ANALOG-DIGITAL CONVERTERS IN INSTRUMENTS WITH CHARGED FEEDBACK

[Abstract of article by Smorygo, O. G.]

[Text] It is shown that algorithms in which the method of symmetrical equalization of the signal to be converted is used must be used as the algorithms of analog-digital converters in instruments with charge feedback (PZS). The basic algorithms of analog-digital converters based on charge feedback devices--algorithms of linear and logarithmic digit encoding analog-digital

converters--are found. The circuit engineering characteristics of designing analog-digital converters based on charge feedback devices are determined. A block diagram of a symmetrical conveyer analog-digital converter based on charge feedback instruments is proposed.

UDC 621.396

METRIC RANGE DIGITAL PHASE INVERTER WITH ELECTRIC CONTROL

[Abstract of article by Kopylov, Ye. A. and Marchuk, Yu. V.]

[Text] The operating principle and circuitry of a digital phase inverter developed on the basis of a bifilar spiral line and designed for automated electronic systems, are considered. The phase inverter is controlled by a digital logical device.

UDC 681.142.622

RESISTOR GRIDS FOR DECODING BINARY-DECIMAL CODES

[Abstract of article by Bogolyubov, N. A. and Khandros, V. O.]

[Text] Circuits for conversion of binary-digital codes to voltage are described. When converting code 8-4-2-1, one can first turn to code 2-4-2-1. In this case the decoder consists of the resistors of three nominals: R, 2R or 1.6R or 1.2R.

UDC 53.082.5

SINGLE-PHOTON AUTOCORRELATION METHOD OF INVESTIGATING SCINTILLATIONS IN NANO-SECOND BAND

[Abstract of article by Viktorov, L. V., Kruzhalov, A. V. and Shul'gin, B. V.

[Text] The characteristics of a single-photon autocorrelation method of recording the shape of scintillations are analyzed. It is shown that the sensitivity of the method compared to the ordinary single-photon method is much higher and reaches units of photons per burst. The results of experimental measurements of scintillations in some solid-state crystalline phosphores are presented that confirm the broad capabilities of the method.

UDC 681.3.068

PROGRAM MODULE PACK FOR CONFIGURATION OF MULTIPROBLEM REAL-TIME DIALOGUE SYSTEMS FOR M-7000 OF ASVT-M AND SM-1/SM-2 OF SM EVM

[Abstract of article by Akol'tseva, L. A., Knyazhanskiy, E. U., Naumova, V. S. and Sadymak, P. A.]

[Text] The structure, functioning and capabilities of dialogue systems with BASIC-RV programming language created from a program module pack are outlined.

Dialogue systems are designed to prepare and solve problems in real time in real-time BASIC language (BASIC-RV). The typical problems solved by these systems are data gathering and processing in production process and scientific experiment automated control systems. The materials of the article were reported at the All-Union Conference "Automation of Scientific Research Based on the Use of Computers. Novosibirsk, 1979."

UDC 681.3.06

AUTOMATED INVESTIGATOR WORK SITE

[Abstract of article by Kazantsev, A. P.]

[Text] A system named an automated investigator work site (ARMI), based on a minicomputer in small configuration with machine graphic devices and with standard CAMAC interface, was developed. The ARMI is a general-purpose interactive system which controls the experiment by programs developed by the experimenter himself. A FOKAL language interpreter and the subsystem of functions built into the interpreter are used. The range of application of the ARMI is spectroscopy, biophysics, biochemistry, chemical physics and so on.



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